AGRICULTURAL

Chemicals

THIS

Microbial Pesticides

Zinc Induced Caking

Preneutralization

Semi-Granular Fertilizers

ESA Reviews '59 Research

Orchardists Discuss New Pesticides

APPLICATOR SECTION

JANUARY, 1960





TOXIMUL R and S . . . at last an emulsifier pair for *all* toxicant systems. Now, for the first time, it is possible to emulsify any of the pesticide types, such as weed killers and chlorinated and phosphated insecticides, with a single emulsifier pair. Better yet . . . you'll do it more effectively. Toximul R and S are your answer to cutting your costs . . . cutting your inventory and simplifying your formulations. You also will find they promote better storage stability even with the more unstable or highly reactive systems. NEW TOXIMUL LF. Another new Stepan product . . . a universal emulsifier for pesticides in liquid fertilizer. Toximul LF, which is extremely low in moisture, will give you maximum efficiency for emulsifying soil insecticides and other toxicants in most liquid fertilizers. It also gives storage stability.

Let us tell you more about these new Stepan products. Send coupon below today!



an emulsifier
team
for <u>all</u>
pesticides

toximul R and S

- . CHLORINATED INSECTICIDES
- . PHOSPHATED INSECTICIDES
- . HERBICIDES



427 W. Randolph Street, Chicago 6 Telephone STate 2-4711





Warehouse Stocks:
Maywood, New Jersey • Tampa • Allanta
Chicago • St. Louis • Daillas
Los Angeles • San Francisco • Portland
In Canada: Charles Tennant & Co., Ltd.
Taranto • Montreal • Vancouver
Send Coupon for Samples

				9.0	CHREACTANTS
MERICA'S	MOST	COMPLETE	TIME C	35	SURFACTANTS

STEPAN CHEMICAL COMPANY
427 W. Randalph Street, Chicage 6, Illinois

Gentlemen:
Please send me complete information and samples of item(s) checked.

Toximul R and S

Name
Firm Name

Street Address

City

2006

State

POTASH COMPANY OF AMERICA

QUICK SERVICE HIGH QUALITY



New 60% Standard Muriate
New 60% Special Granular
Muriate
New 60% Coarse Granular
Muriate
Sulphate of Potash
Chemical Muriate — 99.9% KCL
minimum

Phone, write, telex, or wire us Phone STerling 3-4990, Washington TWX No. — WA—331.

POTASH COMPANY OF AMERICA

CARLSBAD, NEW MEXICO.

General Sales Office . . . 1625 Eye Street, N.W., Washington, D.C. Midwestern Sales Office . . . First National Bank Bldg., Peoria, Ill. Southern Sales Office . . . Candler Building, Atlanta, Ga.



What price weed control?

For 25 cents you can buy enough OLDBURY sodium chlorate to treat about 100 square feet of weed-infested land.

That's a bargain. There's no other way to stamp out weed and grass infestation so cheaply and lastingly.

You need no expensive equipment. There are no costly ingredients to add. OLDBURY sodium chlorate goes on dry—or dissolves easily in water.

One treatment does the job, as a

rule; quickly kills perennial weed and grass top growth; destroys germinating seeds as well as growing roots. The sterilant effect lasts one to two years in heavy soils; up to a year in sandy soils.

Low cost is today's No. 1 reason why Oldbrury sodium chlorate is your best choice for spot control in crops, and for general control on ditch banks, canals, headlands, along fence rows and roadsides. Full-time Hooker agronomists can help you plan weed control programs and can advise you on handling, storage, and application of sodium chlorate. You get fast delivery direct from the nation's leading producer with plants at Niagara Falls, N. Y., and Columbus, Miss. Oldbury sodium chlorate, 99% pure, is shipped in steel drums, 100 and 450 lbs. net.

For further information and prices, write today for bulletin.

HOOKER CHEMICAL CORPORATION

601 Buffalo Avenue, Niagara Falls, N. Y.



NIALK® CHEMICALS
OLDBURY® CHEMICALS
SHEA® CHEMICALS
DUREZ® PLASTICS

Sales Offices: Chicago, III.; Detroit, Mich.; Los Angeles, Calif.; New York, N. Y.; Niagara Falls, N. Y.; Philadelphia, Pa.; Tacoma, Wash.; Worcester, Mass. In Conada: Hooker Chemicals Limited, North Vancouver, B. C.



This Month's Cover

Scene from a new film issued this month by the National Plant Food Institute, Washington, D. C. The film, "Bread from Stone" was previewed in Washington in December. See story on page 102.

Publisher Wayne E. Dorland

> EditorEleonore Kanar

Managing Editor Richard D. McNally

Advertising Manager Ralph Dorland

> District Managers Roger Appleby William Ryan

Circulation Manager David Tryon



Vol. 15, No. 1

January, 1960

Chemical

FERTILIZER INDUSTRY ROUND TABLE—PART 2	26
MICROBIAL INSECTICIDES,—AND THEIR FUTURE By George Decker	30
ZINC INDUCED CAKING IN MIXED FERTILIZER—AND ITS COUNTERACTION By J. H. Caro, H. P. Freeman and J. H. L. Marshall	. 34
ENTOMOLOGISTS EXCHANGE '59 RESEARCH RESULTS-PART 2	. 38
NEW PRENTISS PYRETHRUM EXTRACTION PLANT By Donald Davis	41
WASHINGTON HORTICULTURISTS CAUTIONED AGAINST INDISCRIMINATE PESTICIDE USE	42
FIRST AGRICULTURAL USE OF HELICOPTER IN INDIA	56
PESTICIDE APPLICATION FOR NEMATODE CONTROL	62
IN THE SPOTLIGHT THIS MONTH	11
INDUSTRY CALENDAR	10
WASHINGTON REPORT By Donald Lerch	45
TECHNICAL SECTION	49
THE AGRICULTURAL APPLICATOR	55
PEST ROUNDUP By Kelvin Dorward	65
THE LISTENING POST By Paul Miller	66
FERTILIZER VIEWS AND NEWS	69
INDUSTRY NEWS	71
EQUIPMENT AND BULLETINS	89
PROFESSIONAL DIRECTORY	97
CLASSIFIED ADVERTISING	99
ADVERTISERS INDEX	101
TALE ENDS	102

PUBLISHED monthly on the 1st, by Industry Publications, Inc.

ADVERTISING and Editorial Office, P. O. Box 31, Caldwell, New Jersey.

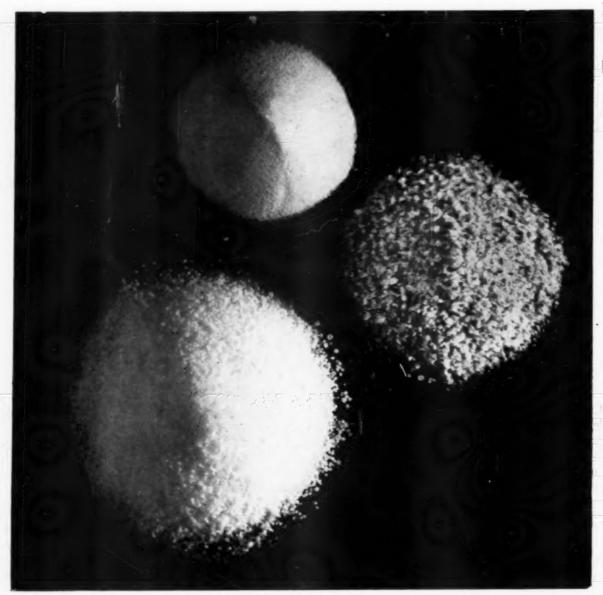
PUBLICATION Office: 123 Market Pl., Baltimore, Md. ENTERED as second-class matter November 4, 1949 at the Post Office at Baltimore, Md., under the Act of March 3, 1879.

SUBSCRIPTION RATES: United States, 1 year, \$3.00; 2 years, \$5.00. Canada and Pan American countries.

1 year, \$4.00; 2 years, \$7.00. All other foreign countries, 1 year, \$9.00; 2 years, \$15.

SINGLE COPIES: current issue: \$0.50; all back numbers \$1.00. Pestage and handling charges for foreign countries on single copies: \$1.00. Claims for missing numbers will not be allowed if received more than 60 days from date of mailing. No claims allowed from subscribers arising from failure to notify the Circulation department of a change of address, or because a copy is "missing from files."

ADVENTISING MATES known on request. Closing date for copy—5th of month preceding month of issue.



To help you make better fertilizers... three grades of specially-sized potash



Muriate of potash ideally sized to meet your fertilizer manufacturing requirements. For mixed fertilizers, you get most potash per ton from our two white grades—Higrade muriate, and Higrade Granular muriate—each contains 62/63% K₂O. For fertilizers requiring a larger particle size, choose our Granular muriate con-

taining 60% K₂O. All three grades are specially refined to resist caking and remain free-flowing. The particle sizes are uniform.

Complete technical data, samples, and accurate shipping information will be furnished promptly by our expertly staffed Technical Service Department on request.

UNITED STATES BORAX & CHEMICAL CORPORATION

50 Rockefeller Plaza, New York 20, N.Y.

שם שם ארות מי מי מי מי מי מי מי

Sauthern Sales Office. Rodes Haverty Building, Atlanto, Coorges
Basic Producers of Potash and Borates for the Festilizer Indust



MEMBER: AMERICAN POTASH INSTITUTE

AGRICULTURAL CHEMICALS



- a dependable product in your agriculture picture
 - for tough-to-mix solutions
 - in solutions requiring 25.2% metallic copper
 - in solutions that need 53% metallic copper

Triangle Brand Copper Sulfate is compatible with most insecticides. It blends evenly in fertilizers as a soil enricher, and in feeds as a dietary supplement.

WATER TREATMENT

Triangle Brand Copper Sulfate controls pond scum and algae in farm waters.

WOOD PRESERVATIVE

It prevents decay and termite damage to fence posts.

For information on formulating with Triangle Brand Copper Sulfate, write

> PHELPS DODGE REFINING CORP.

> > 300 PARK AVENUE, NEW YORK 22, NEW YORK

us Pp

PHOSPHORIC ACID

Wet Process Acid of Highest Quality

Manufactured To The Following Specifications:

52-54% P.O.

Solids less than 1% by weigh

Specific Gravity (60° F.) 1.61-1.73

Shipped in Rubber Lined Tank Cars

For scheduling and requirements -Contact our

Sales Agents

BRADLEY & BAKER

The Country's Largest and most Dependable Source of Phosphate Products for High Analysis Formulations!



A free flowing product of uniform particle size and guaranteed chemical analysis—Will not cake or set up under normal storage conditions— **DIMON** makes possible a wider range of formulations, reduces material costs, increases production rates and produces a better conditioned fertilizer.

For scheduling and requirements-Contact our

Sales Agents

BRADLEY & BAKER

U.S. PHOSPHORIC PRODUCTS TAMPA. FLOR IDA TENNESSEE TO CORPORATION



OF POTASH for the PLANT FOOD INDUSTRY

This symbol stands for high-grade uniform, coarse and granular Muriate of Potash (60% K₂O minimum). Southwest Potash Corporation provides a dependable supply of HIGH-K* Muriate for the plant food industry.

*Trade Mark

Southwest Potash Corporation

SI BROADWAY . NEW YORK &. H. T.

MEETING CALENDAR

- Jan. 6-7—Pesticide Conf., University of Wisconsin, Madison.
- Jan. 6-8—Northeastern Weed Control Conf., 14th annual meeting. Hotel New Yorker, New York.
- Jan. 12-13—Ohio Pesticide Institute. 13th Annual Meeting, Lincoln Lodge Columbus, Ohio.
- Jan. 13—New Mexico Agricultural Chemical Conf., New Mexico State Univ., Univ. Park, N. Mex.
- Jan. 13-15 Agricultural Ammonia Institute, 9th Annual Convention.
- Statler-Hilton Hotel, Dallas, Tex. Jan. 14, 15—Beltwide Cotton Production Conference, Memphis, Tenn.
- Jan. 15 Conference on Pesticide-Wildlife Relationship, National Academy of Sciences, Washington, D. C.
- Jan. 14-16 California Agricultural Aircraft Association, 10th Annual Convention, El Mirador Hotel. Palm Springs, Calif.
- Jan. 19-21—California Weed Conf.. Sacramento Memorial Aud., Sacramento, California
- Jan. 20-21—Arizona Fertilizer Conf., Univ. of Arizona, Tuscon,
- Jan. 20-21 Northwest Agricultural Chemicals Industry Conf., Benson Hotel, Portland, Ore.
- Jan. 20-22 Washington State Nurserymen's Assn., winter convention and trade fair, Olympic Hotel, Seattle.
- Jan. 21—Northeast Region, National Plant Food Institute fertilizer workshop, Hotel Hershey, Hershey, Pa.
- Jan. 25-26—Indiana Pesticide Conf.. Memorial Center, Purdue Univ.. Lafayette, Ind.
- Jan. 27-28—Illinois Custom Spray Operator's School, Univ. of Illinois, Urbana, Ill.
- Jan. 28-29—Colorado Agricultural Chemicals Assn., Annual Meeting, Cosmopolitan Hotel, Denver.
- ing. Cosmopolitan Hotel. Denver. Feb. 1-5 — Purdue Pest Control Operators' Conference, Lafayette. Ind.
- Feb. 6-8-National Cotton Council. Hotel Statler, Dallas, Texas.
- Feb. 8-9 Southwestern Branch. Entomological Society of America, Hilton Hotel, El Paso, Texas.
- Feb. 9-11 Texas Agricultural Chemiculs Conference, Texas Tech. College, Lubbock, Texas.
- Feb. 17-18—Alabama Pest Control Conf., Alabama Polytechnic Institute, Auburn, Ala.
- Feb. 21-23—9th Annual Agricultural Aviation Conference, Texas A&M College, College Station. Texas
- Feb. 22-25—Weed Society of America, Third Biennial Meeting, Cosmopolitan Hotel, Denver, Colo.
- March 22-23—Western Agricultural Chemicals Asso., Miramar Hotel. Santa Barbara, Calif.
- Apr. 6-7—LSU Forestry Symposium. Louisiana State Univ., Baton Rouge.
- Oct. 17-18—Fertilizer Section. National Safety Congress, Chicago.

Trade Listing

National Agricultural Chemicals Association Association Building. 1145 19th St., N.W., Washington. D. C. Lea Hitchner, exec. sec.

National Plant Food Institute, 1700 K St., N.W., Washington, D. C. Paul Truitt and Russell Coleman. executive vice-presidents.

American Potash Institute, 1102 16th St., N.W., Washington 6, D. C. H. B. Mann, president.

American Society of Agronomy, 2702 Monroe St., Madison, Wisc. L. G. Monthey, executive secretary.

American Phytopathological Society, S. E. A. McCallan, secretary.
Boyce Thompson Institute, Yonk-

American Chemical Society, 1155 16th St., N. W., Washington, D. C.

Association of Official Agricultural Chemists, P. O. Box 540, Benjamin Franklin Station, Washington, D. C. William Horwitz, secretary-treasurer.

Agricultural Ammonia Institute, Hotel Claridge, Room 305, Memphis, Tenn. Jack Criswell, executive vice-president.

American Society of Agricultural Enginers, F. B. Lanham, secretary, 505 Pleasant St., St. Joseph, Mo.

Carolinas-Virginia Pesticide Formulators Association, 516 S. Salisbury St., Raleigh, N. C. Hugh Horn, secretary-treasurer.

California Fertilizer Association. Sidney Bierly, executive secretary, Room 213, Ochsner Building, 719 "K" Street, Sacramento, Calif.

Chemical Specialties Manufacturers Association, 50 East 41st St., New York City. Dr. H. W. Hamilton, secretary.

Entomological Society of America. 4603 Calvert Rd., College Park, Md. R. H. Nelson, secretary.

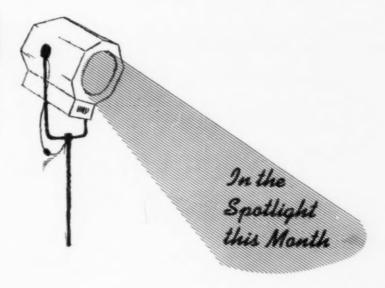
National Fertilizer Solutions Association, 2217 Tribune Tower, Chicago, Ill. M. F. Collie, secretary.

National Cotton Council, P. O. Box 9905, Memphis, Tenn.

Soil Science Society of America. 2702 Monroe St., Madison, Wisc. L. G. Monthey, exec. sec.

Weed Society of America, W. C. Shaw, secretary, Field Crops Research Branch, Beltsville, Md.

Western Agricultural Chemicals Association. Charles Barnard, executive secretary, 2466 Kenwood Ave., San Jose, Calif.



• Cotton Pest Control . . . Entomologists report synergistic effects of DDT-Toxaphene mixtures against boll weevils. Researchers also report that treating cotton seeds with Thimet failed to control weevils in the field for more than three or four weeks. This, they explain, is probably caused by the plant not absorbing the toxicant in sufficient quantity. Page 38.

Agricultural Applicator . . . A report on the first attempt in India
to use helicopters for agricultural purposes and a comparison of
methods of applying fumigants for nematode control. Upcoming
applicator meetings include Illinois Custom Spray Operators' Training School and California Agricultural Aircraft Assn. convention.
Page 55.

• Fruit Pesticides . . . Washington State horticulturists report that Niagara 5943 at ½-pound per 100 is one of the most efficient materials tested against apple mildew, although it is somewhat dangerous to the operator. The antibiotic Phytoactin needs further testing. Page 42.

• Fertilizer Production . . . Preneutralization has a place in mixed fertilizer plants for the production of high nitrogen grades (flat ratios, such as 1-1-1 and inverse ratios, such as 2-1-1). The preneutralization reaction removes heat and moisture from the reacting materials. In granulation of grades such as 1-4-4, preneutralization of the acids should be done in such a way as to preserve the heat of the neutralization reactions. Page 26.

• Microbial Pesticides . . . To be most effective, insect diseases should be self perpetrating and preferably self disseminating in the new habitat. The advantages and disadvantages of the most promising of the "microbial pesticides" are cited by the author in a practical analysis of the future of this approach to pest control. Page 30.

• Fertilizer Coking . . . Addition of zinc to correct deficiencies may be a cause of caking in low nitrogen fertilizers. The caking effects can be overcome by use of ammoniated superphosphate or use of zinc chelates. The authors review physical condition of mixed fertilizer as influenced by various forms of zinc compounds, reporting also on final zinc availability to crops. Page 34.

THESE MEN HAVE LEARNED FROM EXPERIENCE THAT TOXAPHENE MAKES DOLLARS...AND SENSE



Hartford Jackson, Columbia, La. "I set about the best cotton crop I have ever seen, following the toxaphene, toxaphene-DDT control program..."



P. E. Cloutier, Bermuda, La. "We set one of our best crops last year, and we think the toxaphene, toxaphene-DDT insect control program was a big factor. We're basing our 1959 program on the same plan . . ."

D. L. Hall, Endora, Ark. "The toxaphene and toxaphene-DDT control program certainly worked for me, and made me money..."



Morris A. Roberson, Gilliam, La. "I like the early production and early harvest that comes with the toxaphene insect control program. We had good control all season, and I plan to use the same program this year . . ."



W. E. Moore, Sherrill, Ark. "We were able to pick cotton two weeks earlier on the acreage where we followed this program, It really paid off for us.,."



Clarence R. Smith, Cleveland, Miss. "We believe in this program. It gave us excellent insect control, saved us money, and helped us make a cotton crop under adverse conditions..."

H. C. Bradney, Montrose, Ark, "This program saves me expensive late-season applications and does an excellent job. Last year I cut my insect control costs in half..."



O. L. Garmon, Jr., Marks, Miss. "I used the toxaphene program on more than 700 acres of cotton. I know you need to get the overwintered boll weevil, and this program does that. I had good insect control all year . . ."



O. L. Cox. Ruleville, Miss, "I got on he toxaphene program early in the season and continued on a regular schedule. I believe those six early applications paid more dividends than anything we did with our cotton crop all year long..." Insecticide salesmen have to do more than just take orders for dusts and sprays. In the Mid-South, for example, progressive formulators and dealers are showing cotton farmers how a planned, season-long insect control program based on toxaphene can be the most satisfactory—and profitable—practice. These statements from farmers already following such a program reflect the growing interest in more effective use of insecticides.

10059

TOXAPHENE

A product of the Agricultural Chemicals Division

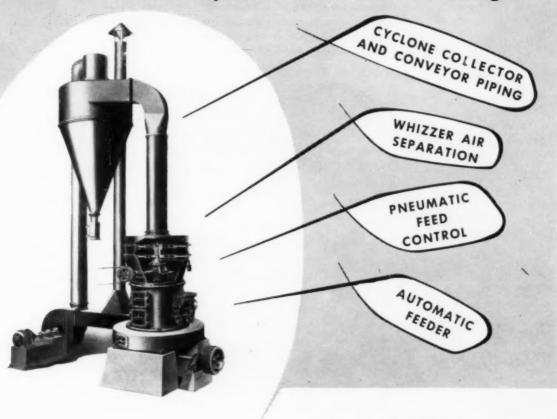
HERCULES POWDER COMPANY

900 Market Street, Wilmington 99, Delaware



RAYMOND High-Efficiency ROLLER MILLS

For All-Purpose Insecticide Grinding





RAYMOND BULLETIN No. 84 will be mailed on request, describing the Raymond line of insecticide grinding mills. RAYMOND Roller Mills are equipped with such outstanding features as Whizzer Air Separation and Pneumatic Feed Control, which help to insure (1) consistent uniformity of finished material, and (2) utmost efficiency in operation by maintaining a maximum "load" on the mill at all times.

Other advantages of these modern mills include the ability to handle all types of concentrate formulations and extremely fine field strength dusts, as well as sulphur bearing products with clean, dust-free, automatic operation.

These slow speed, cool running units give excellent results on certain materials which have a tendency to stick in grinding or blending. Build-ups are eliminated in the mill system, thus permitting long, continuous runs.

Ease of operation, economy in production and record low maintenance costs, are assured in using Raymond equipment. If you have a special grinding problem, write for further information.

COMBUSTION ENGINEERING, INC.
1114 W. BLACKHAWK ST.
CHICAGO 22, ILLINOIS

SALES OFFICES IN
PRINCIPAL CITIES

Combustion Engineering-Superheater Ltd., Montreal, Canada



A pesticide formulation built on Diluex or Diluex A will give the best assurance of adequate field performance. Foilage penetration, uniform coverage, improved adhesion, and minimum toxicant fractionation can be obtained in dusts properly conditioned with these quality products.

... and on the <u>underside</u> of the plant leaves, too!





GRANULAR PESTICIDE FORMULATIONS

Adsorptive FLOREX granules offer a superior base for granular soil pesticides, mosquito control formulations and insecticide-fertilizer additives. Available in standard meshes 20/40 and 30/60. Special meshes tailored for experimental formulas.

Have you received the new Floridin bulletin on agricultural chemical processing? It's free; write today.

FLORIDIN COMPANY

Adsorbents Desiccants Diluents

DEPT. M

P. O. BOX 989

TALLAHASSEE, FLORIDA



The extra care that produces

SWIFT'S PHOSPHATES

builds customer satisfaction and repeat orders for You!



. . . And that extra care is just as real as the people who give it . . . people like your customers . . . people like your friends and neighbors—second and third generation people with the phosphate business literally bred into them working with Swift, the oldest phosphate operator in Florida.

Swift's extra care may very well offer you the opportunity to improve your customer satisfaction . . . your plant operations . . . and your profits. It's worth checking into! Have a Swift Phosphate Center Representative outline the advantages Swift offers you in phosphates—triple, rock or ground rock.

THE SERVICE CENTER FOR ALL YOUR PHOSPHATE NEEDS

SWIFT & COMPANY PHOSPHATE CENTER

·····Bartow, Florida···



To Serve Your Industry Better with phosphate rock, ground phosphate rock and minute man triple superphosphate

JANUARY, 1960

Use the proven XYLENE-BASE Diluent with Dependable Uniformity!

ESPESOL 5



Proved by Formulators Everywhere as

AN ECONOMICAL, NON-PHYTOTOXIC DILUENT!

ESPESOL 5 PROVIDES:

- · Constant weight (pounds per gallon)
- Uniform flash point
- Consistent aromatic content
- · Narrow boiling range



More and more formulators are using non-phytotoxic Espesol 5 because it is an economical water-white, Xylene-base diluent that possesses absolute uniformity. Offer *your* customers a premium product by using this premium quality, high specification diluent in your formulations.

Of advantage to formulators with multi-plant locations is the fact that specifications for Espesol 5 are identical at all Eastern States terminals—no need for changes in your formulations. Available in drum, transport, tank car, barge and ship tank lots. Mail coupon for complete information.

Eastern States Petroleum & Chemical Company

A Division of Signal Oil and Gas Company

0	Eastern States Petroleum & Chemic P. O. Box 5008	al Company
	Houston 12, Texas	A6-D8
i	Please send additional information o	n Espesol 5.
1	1	
ı	Name	
	Title	
	Company	-
	Address	
	City Zone	State

Post Office Box 5008—Houston 12, Texas—Phone WAlnut 3-1651
Chicago Office: 1011 Lake 51., Oak Park, Illinois, Phone VIllage 8-5410
New York Office: 10 Rockefeller Plaza, New York, Phone Circle 7-2520
Cleveland Office: 20800 Center Ridge Rd., Cleveland, Ohio, Phone EDison 3-0188
Louisville Office: 4th and Broadway 51., Louisville, Ky., Phone JUniper 3-7634
Atlanta Office: 3121 Maple Drive, N.E., Phone CEdar 3-3227
Los Angeles Office: 110 S. Euclid, Pasadena, Phone RYan 1-0278
EUROPEAN TERMINALS:
Dordrecht (Rotterdam), Netherlands • Liverno (Leghern), Italy
U. S. Terminals:

Houston, Texas • Chicago, Illinois • East Liverpool, Ohio Madison, Indiana • Brownsville, Texas • Savannah, Georgia Carteret, New Jersey • Los Angeles, California



"It wasn't there last year!"

This is the new 300,000 sq. ft. addition to Kraft Bag Corporation's converting plant at St. Marys, Georgia, scheduled to go "on stream" in February.

Here, in one giant integrated operation, logs from our own forest lands are turned into pulp, then into paper, and finally into heavy duty multiwall shipping sacks, using the most modern machinery and equipment the industry affords.

This expansion of our facilities is one more step in our constant efforts to provide our customers with the best in quality and service.

We invite your inquiries.



KRAFT BAG CORPORATION

Gilman Paper Company Subsidiary

630 Fifth Avenue, New York 20, N. Y. Daily News Building, Chicago 6, Ill.





TRITON X-152 TRITON X-172

Don't finalize your pesticide formulations until you have obtained full information on these two new ether-type emulsifiers developed by Rohm & Haas. They can give you improved spontaneity and excellent stability in your emulsions . . . along with less foaming and better resistance to breakdown during storage. Call, write or wire us now for samples and complete data on new Triton X-152 and Triton X-172.

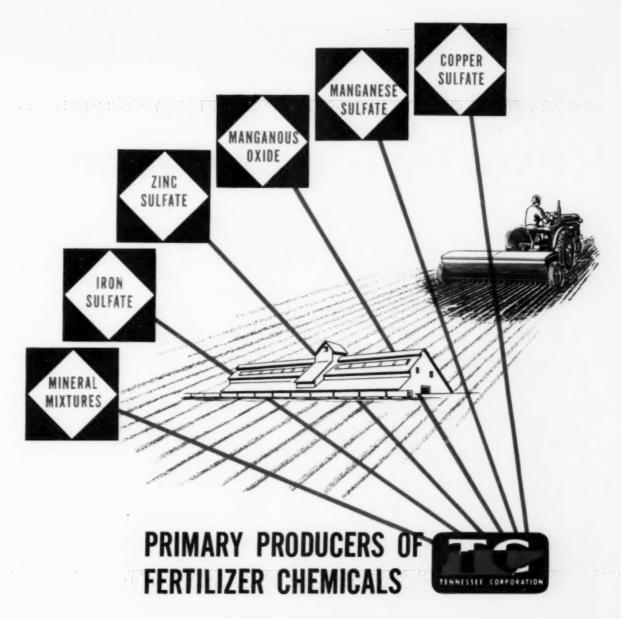
TRITON is a trademark, Reg. U.S. Pat. Off. and in principal foreign countries.



Chemicals for Industry

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA 5, PA.



For more than thirty years we have manufactured highest quality nutritional trace elements for application in fertilizers and maintained a consistent program of research to further improve the quality and performance of these products—Our basic position and background in this field assures you of a plentiful supply of highest quality materials.

Gut Costs with combined carloads from one basic

Cut Costs, save time, plant space and effort by using our custom formulated mineral mixture service—We will supply combinations of minerals mixed to your particular specifications.

Our Products are backed with service, research and technical assistance.

Foliar Nutritional Products Include — Iron, Zinc and Manganese Compounds — NU-IRON, NU-Z, NU-MANESE and ES-MIN-EL a foliar applied mineral mixture.

For samples or literature, make request on your firm's letterhead.



You Don't Have To Wear Guns When You Deal With Spencer...





Spencer leadership in production techniques has resulted in a number of improved nitrogen solutions and several mixing innovations to help you make important savings on production costs and improve your finished products. These include the development of new SPENSOL GREEEN* Nitrogen Solutions (one with an unusually low salt-out temperature, as indicated above), and an improved preneutralization process.

Leave Your Guns At Home...

strapped around his middle.

"You didn't win the election."

needs to wear guns."

When you sell Spencer "Mr. N" Ammonium Nitrate Fertilizer, you don't need to go armed. You don't need to worry about losing friends or customers because of inferior product performance. Also, when you're a distributor for Spencer "Mr. N," you don't have to worry about kicks from dealers because it won't sell.

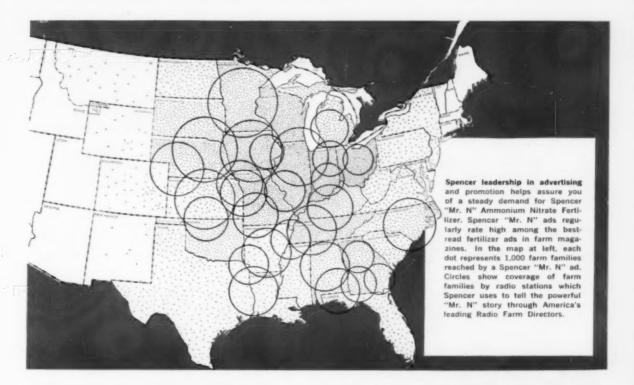
Spencer "Mr. N" has long been the leading ammonium nitrate fertilizer in the Midwest. Wherever it has been introduced it has sold well. Dealers like to sell it. Farmers like to use it. And when they use it, they get results.

But Spencer doesn't try to convince farmers that nitrogen alone is the answer to all their fertilizer needs. Spencer realizes that farmers need to use mixed fertilizer, too—and con-stantly reminds farmers of this fact right in "Mr. N" advertising. It's all part of Spencer's desire to help farmers get results. That makes more friends for Spencer and for you—and is another reason you don't have to wear guns when you sell Spencer

On these pages, you'll find several other good reasons why Spencer is the brand to put your money on.

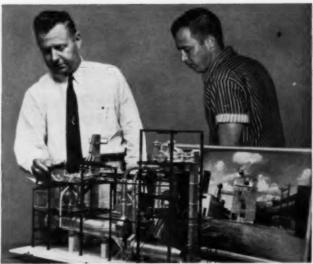
So look 'em over, amigo . . . and let's do business together!

^{*}SPENSOL GREEEN is a registered trademark of





Spencer leadership in packaging means you can sell "Mr. N" with confidence that it will be in good condition. In fact, Spencer guarantees it will flow freely even after a full year's storage under proper conditions.



Spencer leadership in Technical Service assures you of expert assistance in solving problems in engineering, formulation, plant design, granulation, preneutralization and personnel training. A highly trained team of Tech Service specialists stands ready to assist mixers in Spencer's marketing area.



"Don't just fertilize ... Spencerize"

SPENCER CHEMICAL COMPANY, Kansas City, Missouri Producer of 4 Nitrogen Spencerizers for hungry crops A NEW Measure of Values for Mixing Triples . . .

OF NEW DAVISON HI-FLO
RUN-O-PILE TRIPLE
SUPERPHOSPHATE IS
THE ONE SURE WAY TO
PROVE TO YOURSELF
THAT HI-FLO CAN SOLVE
YOUR MIXING PROBLEMS

... whether they be quality, delivery, dependability or service. LET'S TALK!

W.R. GRACE & CO.

AVISON CHEMICAL DIVISION

BALTIMORE 3. MARYLAND



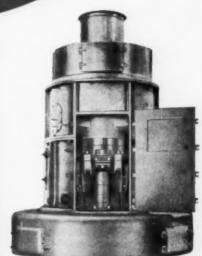
High Capacity
for Ammoniation
Unexcelled Parasity
Guaranteed 46/47%
available P2Os



WHERE UNIFORM FINENESS IS DESIRED... WHERE MINIMUM MAINTENANCE IS REQUIRED

The Bradley Pneumatic Hercules Mill provides uniform grinding of limestone, phosphate rock, etc. from 20 to 325 mesh. Its durable, non-clogging vibratory feeder practically eliminates manual feeding... allows continuous operation of the mill at its maximum capacity. And because the Bradley Pneumatic Mill is installed on a foundation flush with the floor line, it not only reduces foundation costs but simplifies inspection and maintenance. All grinding parts are also easy accessible... and both grinding die ring and roll assemblies can be removed without dismantling the mill. Add rugged construction to this, and you have a mill where dependable, uniform grinding is combined with an absolute minimum of replacements and downtime.

See Chemical Engineering Catalog or for complete information, write for Catalog No. 63



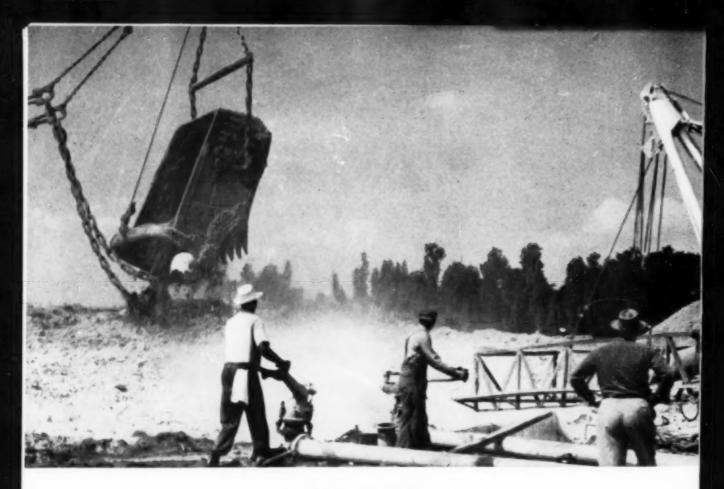
BRADLEY PNEUMATIC HERCULES MILLS



BRADLEY PULVERIZER CO.

superior grinding equipment since 1891

LONDON ALLENTOWN, PA. BOSTON



THEY MOVE MOUNTAINS TO SHIP CARLOADS

Cyanamid literally moves mountains of high-grade phosphate ore to ship carloads of Trebo-Phos... the triple superphosphate with controlled porosity.

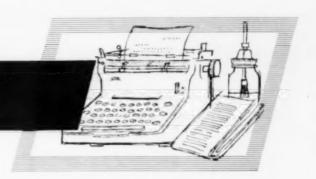
To ship you the highest quality triple superphosphate, Cyanamid's "walking giants" scoop up twenty-four ton bucketfuls of high-grade phosphate ore at the rate of one ton every one and sixtenths seconds. To make one carload of TREBO-PHOS*, approximately 340 tons of ore are mined. This tonnage dwindles as the ore is washed, screened, graded and dried. Much of the remaining is

used to make highly concentrated phosphoric acid which, when added to fine rock, makes triple superphosphate. Quality is checked at every stage...the result: a triple with controlled porosity.

Its characteristic: ammoniation rates as high as 5% without evolution of ammonia fumes, yet TREBO-PHOS particles will not take on excess amounts of moisture. The finished product is a dry, drillable, well-conditioned fertilizer. American Cyanamid Company, Agricultural Division, New York 20, N. Y. *TREBOPHOS is American Cyanamid Company's trademark for its triple superphosphate.



EDITORIALS



HERE have been some big changes in the pesticide field over the past ten years. Today the emphasis is on a long list of new, patented, tradename products which are gradually replacing the old stand-bys such as DDT, BHC, 2,4-D, etc. And, we might add, there are some in the industry who will not be unhappy to see the last of these work horse products. They have done an efficient pest control job for the user, they have played an important part in creating a healthier and more pest-free world, but for many of those involved in production and sale they have not always been too profitable. Price competition has been intense, a number of producers have long since dropped out of the market because of dissatisfaction with profit margins, and many formulators, dealers and distributors have found that, with the strong emphasis on price, there was no margin left over to allow any budget for marketing and sales promotion.

As the new products take over, it is quite evident that those who have developed and are introducing them are determined that they will not suffer the same fate as the older products. They want them to be sold by a limited number of outlets who are willing to follow through with intensive introductory marketing support so that they will have the best chance for success. They don't want them offered by every firm in the pesticide business, each time at a lower price. They want to be sure that they are properly formulated and intelligently applied at the proper time, in the correct concentration and on appropriate crops, so that they can perform efficiently the work they are designed to do.

There is a lesson for formulators in their experience with the older products. Over emphasis on price, they should have learned, creates no markets and makes no profits for anyone. And they should realize that if they start making the same old mistakes with these new products, there will be more and more basic producers who will decide it is better to do the marketing of promising new products themselves. Once in the market, of course, it is often difficult to get them out. The way to keep them out is to keep them from getting in.

If intelligent, adequately financed formulators are prepared to help with the introductory phase of presenting new products to the market, and smart enough to keep enough profit in the products to justify adequate sales promotion, they could reverse this trend toward basic producers selling direct.

T seems clear that 1959 was a big sales year for fertilizers. Trade estimates suggest there may have been a gain of five or six per cent over the previous year, itself the best year on record.

A great deal of credit for the increase, incidentally, must go to the NPFI market expansion program. Now in full swing, this program effectively combines soil testing, demonstration plots, farmer meetings and all types of educational material to persuade farmers of the economy of making optimum use of plant foods.

As for the coming year, — we anticipate the biggest sales in the history of the fertilizer industry in 1960. The trend toward higher analysis fertilizers will no doubt continue, and both granulated fertilizers and liquids should extend their recent gains — as more and more farmers get the message that effective use of fertilizers can mean increased yields (and profits) at lower unit costs.

PRENEUTRALIZATION . . .

a further development in improving granular fertilizer production.

Part two of AGRICULTURAL CHEMICALS' report on the 1959 Fertilizer Industry Round Table.

"Economics and Production — Two Primary Considerations in Deciding on Preneutralization"

THE use of a preneutralizer to manufacture granulated mixed fertilizers is a recent development in the fertilizer industry that has followed granulation by only a few years", observed Grant C. Marburger in a review of preneutralization prepared by himself and Larry L. Lortscher,—both of Spencer Chemical Co. "Neutralizers have been used for many years to produce ammonium sulfate, nitrate and phosphate. The pre-neutralizer is an adaptation of the neutralizer."

Mr. Marburger indicated that preneutralization has a place in mixed fertilizer plants for the production of high nitrogen grades. Flat ratios such as 1-1-1 and inverse ratios such as 2-1-1 and 3-2-2 also fall in this classification. In the high nitrogen grades,-overgranulation is the basic problem. If some of the excess temperature and liquid can be removed by prior reaction, a reduced liquid phase is achieved. In other words, preneutralization removes heat and moisture from the reacting materials in the preneutralizer before the reacted material enters the granulator.

Economics and production of inverse ratio fertilizer grades are two primary considerations in deciding whether or not to preneutralize, stated Mr. Marburger. Whether preneutralization is advisable in the plant depends on a formula-cost calculation to determine whether money can be saved on grades being produced. Cost savings will depend on: (1) the cost spread between solid and liquid nitrogen; (2) cost spread in phosphates (normal and triple, or normal and H₂PO₄); and (3) the cost of sulfuric acid.

As to the production of inverse ratio grades, the need for these grades is a market consideration for a particular sales area. If a potential market exists, is developing or can be developed, preneutralization becomes worthy of consideration.

Beyond the two primary reasons for considering preneutralization as applicable to a plant process, there are some secondary benefits that may be achievable, observed Mr. Marburger.

The first of these side benefits is less recycle. By removing heat and moisture, the need for so much dry material is removed. Another secondary benefit is less fumes,since the neutralization of ammonia is carried to completion prior to its introduction into the potash materials. Fumes are not necessarily eliminated completely, however, since exessive temperatures will create fumes with apparent decomposition of material. Still a third benefit, which can be listed, is the distinct possibility of less nitrogen loss.

Mr. Marburger pointed out that production rates that are ultimately possible, using preneutralization, are not fully known. "Most generally, there's a bottle neck in some other part of the plant that doesn't allow the preneutralization section full performance. Today's experience ranges at 18 to 15 tons per hour, and higher rates have not had time to be fully resolved." Some initial problems limiting production rates, all concerned with the preneutralizer tank itself, resolve around an inter-relationship of violence of reaction, splashing or spattering, surging and mixing. Splashing itself is not of concern, for with a closed vessel, it cannot hurt anything. Surging from the tank into the ammoniais correctible by several methods. The close inter-relationship of these isolated problems with nitrogen loss, amount of mechanical mixing, and the sparger arrangement becomes a more complicated problem in equipment design.

The Pre Reactor For Liquid Raw Materials

CONTINUING the discussion on preneutralization, N. K. Alfrey, Davison Chemical Co., described reactions in the conventional processes for making granulated fertilizer, and remarked that in the ammoniator, a uniform blending of liquids and solids occurs, and certain desirable chemical reactions

take place, primarily neutralization of sulfuric and phosphoric acids to form ammonium sulfate and ammonium phosphates, and reaction of ammonia with superphosphates to form ammonium phosphates and dicalcium phosphate. "Certain undesirable reactions may also take place," he observed,—specifically (1) the formation of dense fumes (ammonium chloride resulting from some of the acid reacting with potassium chloride to form hydrochloric acid, which reacts with ammonia) (2) decomposition of various nitrogen compounds to nitrogen oxides and elemental nitrogen,—resulting in significant nitrogen losses; (3) concentrations of the decomposition gases to such an extent that flash fires are a threat; and (4) incomplete absorption of ammonia, to result in nitrogen loss.

Mr. Alfrey pointed out that these problems can be overcome, or at least minimized if the sulfuric and phosphoric acids are neutralized before introduction into the ammoniator. He cautioned, however, that in granulation of such grades as 1-4-4, preneutralization of the acids should be done in such a way so to preserve the heat of the neutralization reactions. In such grades, one of the principal functions of the acid is to generate heat as an aid to granulation.

A number of preneutralization processes have been developed which operate on the principle of neutralizing the acids in an open tank, with substantially the stoichiometric proportion of ammonia or nitrogen solution, and separate introduction of the additional ammonia or nitrogen solution required for ammoniation of the superphosphates. These processes, pointed out Mr. Alfrey, are particularly advantageous for the high nitrogen ratios such as 2-1-1, where external removal of water and heat are helpful. Certain disadvantages, however, led to work done at W. R. Grace & Co. to develop a prereactor in which all of the liquid raw materials could be combined. reacted and introduced into the ammoniator in a single stream. Mr. Alfrey described the unit developed, which is based on a simple tee and a concentric pipe arrangement. Laboratory results and operation of a full scale installation at Davison's Trenton process plant at Curtis Bay, have been successful, with the added benefits of no formation of toxic gases and no significant decomposition of nitrogen compounds in the prereactor.

Each liquid raw material is metered and supplied to the prereactor through conventional instruments and piping. The supply lines are provided with a gate valve, check valve and a pressure gauge.

Water and nitrogen solution blend in a tee, discharge into a pipe section where it blends with anhydrous ammonia. These preblended liquids flow into a pipe tee called the reactor tee,

Sulfuric acid and phosphoric acid preblend in a pipe tee and flow subsequently through a discharge pipe, passing concentrically through the reactor tee, terminating in a showerhead arrangement in the reactor pipe section. The showerhead is to break up acid flow into small streams, thus assuring that neutralization by ammonia is largely completed in the reactor pipe section. The preblended and prereacted liquids then discharge laterally into the lower region of the pug mixer, about two feet beneath the surface of the dry materials. Design and location of

the discharge pipe, reported Mr. Alfrey, was made with due regard for two important aspects of mixed fertilizer granulation, ie, efficient ammoniation of the superphosphates and uniform wetting of the dry materials.

Maximum and minimum limits on use of the various liquid raw materials have not yet been established, remarked Mr. Alfrey, but performance thus far indicates considerable flexibility. Schedules have not yet permitted granulation of the high nitrogen 2-1-1 and X-O-X ratio grades,—but both types of grades are expected to be sucessfully produced in the process.

Performance of the prereactor in plant granulation operations has been satisfactory, and its use has resulted in important improvements, remarked Mr. Alfrey. The heavy ammonium chloride fume from the mixer has been eliminated by neutralizing the mineral acids inside the pipe. Other advantages to the granulation operation include: unobstructed mixer paddle action; more uniformly regulated wetting of the materials being granulated; and automatic means for clearing partially clogged discharge orifices.

liquids from prereactor enter ammoniator in single stream

USDA expert reviews principles of segregation and resulting problems in fertilizer production

ME of the reasons segregation presents a serious problem in the fertilizer industry," remarked W. L. Hill, USDA, "is because it is impractical to obtain a true sample." State chemists, for example, are especially concerned with sampling in determining if a product meets grade guarantee.

Usually fertilizer homogeneity is judged on the basis of chemical analyses, because this criterion is implied in the guarantee. In the study of segregation problems, however, physical homogeneity possess prime interest, and properly so, for physical homogeneity implies chemical homogeneity, whereas the converse is not necessarily true.

One kind of segregation occurs during pouring operations, reported Mr. Hill. Sorting of particles of different sizes and densities in mutually hindering fall through eddying air takes place in conformance with known rules. A different set of rules applies when the granules strike a conical pile. Plant operators know how to minimize this type of segregation. Another kind of segregation occurs as a consequence of vibration. Settling in the pile or bag is an instance of mild vibration or jostling.

Segregation may be localized and randomized, and thus not be a cause of serious concern, so long as the typical sample is not thereby made too large. In fact, this form of segregation occurs normally in mixtures described in trade as non-segregating ones. When, however, size sorting proceeds to the point of general stratification in the lot, segregation has reached its worst by any standards. Stratification occurs when a mixture of large granules contains some granules that are small enough to pass through the inter-granule channel-ways. Moderate vibration causes the small ones to fall to the bottom.

"Semi-granular-type" fertilizer can be produced with a minimum investment. Prime requisites: skill and experience.

SEMI-granular fertilizer production at F. S. Royster Guano Co. was reviewed by Theodore Schmalz, who observed that success and ease of this type fertilizer production varies considerably with the grade of fertilizer produced. In the south, he said, very popular semi-granular grades are:

> 4-10-7 4-12-12 4-10-10

In the north, 5-10-10, and 8-16-16 are more common. There is no recycle in the semi-granulation process, observed Mr. Schmalz. Primary control is achieved by the raw materials in formulation. Best results have been obtained using a coarse or granular potash; superphosphate instead of triplesuper; and the ammonia source from one of the solutions. In high nitrogen grades, ammonium nitrate is suggested, while urea is suggested for low nitrogen grades, 80 to 130 lbs. of sulfuric acid (66° Be) is used in the Royster operation. Mr. Schmalz indicated that too much ammonia loss occurs if a higher quantity (than 130 lbs) of acid is used,-while if the acid quantity falls below the lower limit, the resulting product is too fine. Commenting further on raw materials, Mr. Schmalz pointed out that superphosphate offers better binding and covering properties than

triplesuperphosphate. A moisture content averaging 3% may be one reason, he said, for minimum reversion of P₂O₅ in the Royster Guano operations.

Mr. Schmalz suggested that long distributor pipes be used for best distribution of materials. Poor distribution, he said, can result in flash fires and non uniformity of size.

George Walton, Tennessee Corp., Cincinnati, reported on production of "grained" fertilizers (a semi-granular type) at the Cincinnati plant of Tennessee Corp., describing particularly application of the Eyman process in fertilizer production. Mr. Walton observed that "grained" fertilizers are dust free, have a wide size range. They store and drill well, and do not segregate in the pile to any noticeable extent.

Mixing and graining of the fertilizer takes place in a 1½-ton Atlanta Utility mixer, in which all flights have been cut down to within 5" of the shell (except for the flights at the discharge end) reported Mr. Walton. A sparger similar to that of the TVA is used, and the solution, acid, water and ammonia are admitted below the rotating bed of solids. The cycle takes 3½ to 41/2 minutes (depending on grade of fertilizer produced), and the mixer discharges

to a 16' x 20' cooler. A scalping screen takes oversize to the mixer.

In the graining process, said Mr. Walton, drying is effected by the heat of reaction. Steam is retained in the mixer under pressure, and fume and dust control is lower than in conventional granulating. The liquid phase of the product is contained in the surface of the particles, and expends a binding action. 7½ units of nitrogen are currently obtained from solutions. (Grades which have been produced include a 10-10-10 and 12-12-12).

Best results in the graining process, said Mr. Walton, occur with raw materials in a granular form. Some fines in the potash or phosphate are beneficial as binders or coaters. Mr. Walton observed that more ammonium nitrate can probably be used in his operation, and this is one line of investigation he expects to follow.

The graining process, said Mr, Walton, requires a minimum investment,—the essential equipment being a mixer, conveyor and a cooler. Thus the operating cost is low. An expert operator, however, is essential.

The Block Sparger

Commenting on Semi-granulation, J. Sharp, Spencer Chemical Co., observed that liquid phase is essential to agglomeration,-that temperature is important because it affects solubility, and that materials with plasticity are required for agglomeration. To achieve semi-granulation of low nitrogen grades, sulfuric acid must be added, with a resulting smog problem due to the reaction of acid with potassium chloride and the nitrogen solutions. Mr. Spencer described the block sparger designed by Spencer Chemical engineers which offers the advantage of a minimum of smog formation. He remarked that the block sparger was originally designed for continuous granulation,-but that it is still very effective for batch operations.

In a concluding discussion on semi-granulation, it was cautioned that cutting off flights in a mixer can result in buildup of oversize, while a second question on the modified mixer raised the point that plants might require two mixers, one for the semi-granular operation, and a second, non-deformed mixer, for regular mixed fertilizers.

A practical approach to fertilizer formulation requires among other factors a realistic analysis of materials and equipment available.

THE fact that questions continue to be asked on formulation practices," stated W. J. Tucker, G.L.F., is an indication of the intense interest in formulation; particularly as it relates to granulation." Mr. Tucker detailed the calculations required to come up with a starting formula for production, using the raw materials available. An outline of the approach to any formulation problem was stated as follows:

I—Assess the materials on hand, listing their nutrient analysis and moisture content, as indicated by shipper's analysis, or by company lab analysis. Decide upon the ammoniation rates which will be used.

Decide on the overages of

Decide on the overages of plant food to allow.

Decide on the end product moisture content which is desired.

II-Set up and solve the necessary equations, which reflect the known facts, assumptions, and end product requirements stated above.

III—Complete, extend and check the formula against the original requirements.

Mr. Tucker pointed out that it is particularly important that an operator adapt to his operations the existing materials. It is of little consequence to an operator that a particular nitrogen solution, acid, or superphosphate is best to use, if he does not have on hand these particular materials.

Mr. Tucker then worked out in detail calculations in the formulation of a 8-16-16 granular fertilizer, using 61% muriate of potash; 44% nitrogen solution (22-66-6); ordinary super, 19.5% APA; triple super 46% APA; and 54.5% wet process phosphoric acid.

H. H. Tucker of Sohio Chemical Co., continued the discussion on formulation calculations, emphasizing in his report the use of three and four-component materials and discussed relationships and solubilities. Also appearing on the panel dealing with formulation were T. R. Schmalz, F. S. Royster Co. and J. E. Reynolds, Jr., Davison Chemical Co.

Complete "Proceedings of the 1959 Fertilizer Industry Round Table" are being compiled by the Round Table Association.

Copies will be available about April, 1960 at \$3.00 a copy, and reservations may be placed now. A limited edition of the Proceedings will be printed.

Send orders to:

H. L. Marshall executive secretary 1604 Walterswood Rd Baltimore, Md.

John Hardesty, USDA, led off the discussion on problems in handling and manufacturing conventional fertilizers, and pointed out that moisture is probably the one most important factor in fertilizer caking. Most of his comments dealt with the influence of ammoniating solutions, and crystallization in mixed fertilizers.

He listed control factors as: (1) water content of the fertilizer;

(2) proportion of soluble salts in

solution; (3) chemical reaction; (4) temperature; (5) contacts between particles—size, shape; and (6) mechanical pressure, height of pile. Mr. Hardesty indicated that data on the liquid phase of ammoniating solutions would be of great value to plant operators, and presented data on the relative volumes of aqueous solutions saturated with urea and ammonium nitrate in varying proportions at 86°F.

G. R. Gilliam, Nitrogen Division, commented on the use of urea-ammonium nitrate solutions, and noted that the major advantage in the use of these solutions is the low salting out temperature and consequently improved condition of the fertilizer. A greater solubility of total nitrogen is also possible in the urea-nitrate solutions, having some free ammonia in solution with the urea. Mixtures of fertilizers including urea are more hygroscopic than those made with salts alone. This feature, however, is not necessarily bad, he reported, since increased hygroscopicity in pulverized grades has shown definite advantages.

J. W. Lewis, E. I. du Pont de Nemours Co. continued the discussion on ammonia liquors in conventional fertilizers, observing that a series of progressive chemical reactions is started when ammonia, either as anhydrous or free ammonia in ammoniating solutions, is added to the superphosphates. The nature of these reactions depends on the amount of free ammonia added, temperature and storage time, and moisture content.

Each of the reactions improve the condition of the superphosphates and the mixed material,—it is therefore desirable to add the maximum amount of ammonia; However, beyond a certain limit, the ammoniation reaction results in reversion of the P_2O_5 to form basic calcium phosphates that are unavailable.

Conclusion of Agricultural Chemicals' report on the Round Table will appear in the February issue,

MICROBIAL INSECTICIDES

—and their future

In the wake of the pesticide industry's poor press, further misinformation on pest control is seeping into consumer and trade literature.

Writers not familiar with the history of economic entomology pounce on each suggestion new to them as if it were new to science—thus many old procedures are

being presented as new ideas.

Research on use of radiation and potentialities of hormones are of comparatively recent origin. But use of insect pathogens, parasites and predators, crops resistant to insect attacks, non-toxic chemicals that will desiccate insect bodies,—have been the subject of research for many years.

NON CHEMICAL 'PESTICIDES' LEAVE MUCH TO BE DESIRED FOR PRACTICAL PEST CONTROL

N recent months, the agricultural press has carried numerous stories and editorial references to promising new approaches to the age-old problem of insect control. These include the use of certain cultural practices, crops resistant to insect attacks, parasites and predators, non-toxic chemicals that would desiccate insect bodies. growth-regulating hormones, various forms of radiation, and insect pathogens. Research on the use of radiation and the potentialities of hormones is of comparatively recent origin, but all of the others. including insect diseases, have been the subject of research for many years. Each has made some substantial contributions to the science of economic entomology, but despite years of extensive and in many cases intensive research, individually and collectively they have left much to be desired in the way of practical and economically sound insect control practices. Over the years, insecticides have played an ever-increasing role in meeting these needs, until today millions of pounds of insecticidal chemicals are used annually.

As more toxic substances came into common use and the annual consumption of insecticides increased, it was only natural that the question of possible hazards to man, his domestic animals, and

By George Decker*

wildlife would be raised. This, of course, was proper and commendable, but it is unfortunate indeed that a whole series of unfounded scare stories based upon wild speculation and misinformation created an atmosphere of widespread fear and distrust. With a large segment of the public apprehensive and somewhat bewildered by conflicting reports, a host of would-be leaders are looking for some simple solution to the problem. Many writers not familiar with the history of economic entomology pounce upon each suggestion new to them as if it were new to science, and thus we find many of these old procedures presented as new

Now that we have chemical control measures that will give reasonably adequate control of most of our important insect pests and our food and fiber needs are safeguarded by reserves accumulated through 10 years of overproduction, it seems fitting and proper that we should devote greater emphasis to a re-examination of the potentialities of these old approaches to insect control in the light of the advances that have

been made in all branches of science and technology.

Lest there be those who feel that entomologists are wholly and unreservedly committed to a program of chemical control of insects, it should be pointed out that traditionally most entomologists have held to the fundamental concept that insect control is or should be largely biological in nature. Since nature can and does do such an excellent job of establishing and maintaining balances between species and establishing limitations on species, it would seem logical that man, to be most successful in influencing plant or animal populations, should thoroughly study and then attempt to emulate nature. This he can do and has done successfully in many instances.

In years gone by, biologists quite generally devoted most of their research time to biological and ecological studies, and at one time biological, ecological, cultural, and mechanical control measures dominated all pest control activities. As a matter of fact, in most instances biologists are prone to regard the use of chemicals-insecticides, fungicides, acaricides as emergency or fire-fighting methods to be used largely where appropriate ecological methods have not been developed or have not been applied properly.

^{*}Presented at the American Farm Research Association Conf., Madison, Wisconsin, July 15-17, 1959.

With the foregoing brief review of the history of economic entomology, we can more intelligently proceed to consider the role of insect diseases in insect control. Insect diseases are not new. Some of the diseases of the honey bee and the silkworm have been known for centuries, and the earliest writings on entomology in this country contain frequent references to fungus diseases. Dr. S. A. Forbes was one of the pioneer investigators in this field, and while others before him had made notes of entomophagous fungi and other evidences of disease, S. A. Forbes was the first to examine the possibilities of control of insects by their diseases. In fact, he is regarded by many as the father of insect pathology in the United States. His work on the chinch bug fungus and the work by Dr. F. H. Snow of Kansas are outstanding classics of early research in this field.

Forbes did not limit his interest and research in insect pathology to chinch bug diseases. He noted ,and in many cases studied in great detail, the diseases found in numerous lepidopterous larvae, aphids, white grubs, grasshoppers, and several other insects. In the late 1880's he was strongly advocating more thorough studies on the possible advantageous uses of contagious insect diseases, and his Eighth Report (Nineteenth Illinois Report), published in 1895, contained a monograph of nearly 150 pages on chinch bug diseases. In general, the success of attempts to propagate insect diseases and to disseminate them as a means of controlling noxious insects in Illinois has not been as spectacular as sponsors and interested observers had hoped.

No doubt most of the diseases of our indigenous insect pests are about as widely distributed as their hosts, and many may be universally present. Under favorable conditions these pathogens thrive and under adverse conditions they decline until, for all practical purposes, they tend to disappear, only

to return again with surprising suddenness and telling effect when environmental conditions again become favorable.

It was rather extreme dependence of the pathogen upon a favorable environment, with particular emphasis on its temperature and moisture requirements, that led to the abandonment of many attempts to utilize insect diseases to combat noxious insect pests. The fate of the chinch bug fungus in the Midwest is a classic example. In the early 1900's Snow, Forbes, and other enthusiastic advocates of the use of the chinch bug fungus finally came to the conclusion that chinch bug fungus spores were universally present, that under favorable conditions the disease would appear spontaneously, and that in general the quantities of spores that they might disseminate would not add appreciably to the amount of inoculum already present. This and similar experiences eventually led to the quite generally accepted assumption that it is highly probable our indigenous insect pests and their naturally occurring diseases have long since established a sort of balance, and the possibility that man might upset this balance in his favor is more or less remote. In any case, I know of no instance in which this feat has been accomplished. It should be noted, however, that in much of the early work, man's efforts were directed towards the initiation of an epizootic that would be self-disseminating, if not indeed self-perpetuating.

While a small group of optimists look to the use of pathogens for the ultimate solution of our insect control problems, another sizable group of pessimists who are cognizant of man's failures in the past disdainfully ask "Why waste more time and funds on a futile study of insect diseases?" In answer I would say we have two good basic reasons for undertaking a thorough study of insect pathogens. (1) To obtain a better understanding of their role and relative importance in the natural control of insects, and (2) to determine the nature and extent of their practical usefulness in applied or so-called artificial insect control operations.

Natural Control

It is a matter of record that many historic insect outbreaks have followed prolonged periods of environmental conditions highly unfavorable for the development of pathogenic organisms. It is also well known that large-scale epizootics have been associated frequently with the termination of major insect outbreaks. It has not been clearly established that these observations have any true cause and effect relationship, but it seems highly probable we are not dealing with a simple coincidence.

In years past, biologists generally have been prone to overemphasize the obvious effects of

By George Decker Illinois Natural History Survey Urbana, Illinois



weather, parasites, and predators in accounting for fluctuations in insect populations, but as time marches on it becomes increasingly apparent that the role of insect diseases in maintaining the so-called "balance of nature" has been greatly underestimated and in some cases almost totally overlooked. It now seems quite apparent that every insect pest is subject to attack by one or more, if not a whole host, of diseases.

The failures of the past notwithstanding, the very fact there is an urgent need for a much better understanding of the basic factors in natural control of insects, and the factors responsible for major fluctuations in insect populations is ample justification for expanded research in the field of insect pathology. It was on this basis that the Illinois Natural History Survev initiated work in this field eight years ago, and we now have one full time staff member, one full time technician, and three graduate students working on the project. Naturally, we are hopeful of an unexpected breakthrough, but that is not our major objective.

Artificial Control

THERE are two quite distinct approaches to insect control:

(1) Population management wherein on a large area basis, man attempts to reduce insect populations to non-economic numbers and to hold them at that level; and (2) crop protection where individual fields are treated for their protection. The evidence at hand indicates that at least some insect pathogens may find a place in one or the other, if not in both, of these fields.

Many of our most destructive insect pests are immigrants from abroad. Fortunately for them and unfortunately for us, they left most if not all of their parasites, predators, and diseases behind; thus in the area of insect population management or control, the intro-

duction and dissemination of many parasites and predators as well as a few pathogens has been highly profitable. To be most effective in this type of usage, the pathogen should be self-perpetuating and preferably, at least to some extent, self-disseminating in the prevailing environment of its new habitat. One of the most spectacular introductions of this type was the Canadian importation of the European polyhedrosis virus disease of the European pine sawfly, Neodiprion sertifer (Geoff.). It has proved highly effective in controlling this sawfly in Canada, and has been established successfully in the United States. In a co-operative effort, the Illinois Natural History Survey, United States Department of Agriculture, and Illinois Conservation Department introduced this virus disease obtained from Canada to combat a serious outbreak of the European pine sawfly that in 1952 was raging out of control in the Henderson State Forest. The virus took hold in a spectacular fashion, and sawflies died by the thousands. Whether the virus can be given full credit or not remains to be determined. In any case, the sawfly has not been reported as doing serious damage in that area since 1953.

Less spectacular but perhaps much better known has been the very successful use of the milkydisease, Bacillus polilliae Dutky, used to control the Japanese beetle, Popillia japonica Newman, in the United States. More extensive use of this organism has been retarded by the fact it is slow in its action, and often takes months or even vears to become effectively established. Thus, to date it has been of little value in retarding the spread of the Japanese beetle in newly infested areas. As yet no one has been able to produce this organism on artificial media, although it is believed this handicap can be overcome. In fact, at least one

laboratory is hopeful of accomplishing this feat in the very near future. Success in this venture should pave the way for extensive usage of the milky disease, for its use promises to combine safety, economy, and perhaps permanence.

A microsporidian disease of the European corn borer, Pyrausta nubilalis (Hbn.), caused by Perezia pyraustae Paillot is another example of interest to Midwesterners. The origin of this disease is uncertain, but about eight years ago it was isolated from diseased corn borers collected in Iowa and in northern Illinois. The disease was introduced artificially into all sections of the state by colonizing infected borers in many widely scattered counties. It is now prevalent in all parts of the state and has for several years been an important, if not the most important, factor in holding corn borer populations to relatively low levels. where they can be successfully controlled by other means at a greatly reduced rate.

Now we come to a consideration of the possibility that disease organisms formulated as sprays, dusts, or granules may be applied to crops to protect them from existing or impending insect attack. This is the one relatively new proposal in insect pathology, and the proposed use of living organisms in this manner led to the coining of such terms as "living insecticides" and "microbial insecticides." A host of organisms including viruses, bacteria, fungi, protozoa, and nematodes known to be parasitic on insects are being studied in laboratories all over the world. Many have been reported as showing considerable promise in preliminary field tests. The most extensively tested and by far the best known of these, Bacillus thuringiensis Berliner, is now being produced on a commercial or at least on a pilot plant basis by at least

three companies. Thus it may serve as a type example for our discussion on this subject.

What the future holds for B. thuringiensis and similar pathogens remains to be determined. The fact that they have shown considerable promise in preliminary tests is encouraging, but at the moment even their most enthusiastic advocates will agree that much additional testing under controlled conditions and under a wide variety of actual field conditions will be needed before any safe and sound conclusions can be reached. Steinhaus and others have listed some of the advantages and disadvantages to be considered in the evaluation of microbial insecticides, and perhaps a point by point consideration of these pros and cons will prove effective in leading us to some tentative conclusions.

Advantages Claimed:

 The harmless and nontoxic nature of insect pathogens for other forms of life; hence, the absence of toxic residues.

This may be a correct assumption, but I suspect the Food and Drug Administration and the United States Department of Agriculture will require some rather substantial proof of safety. The evidence required may be both difficult to obtain and costly.

The relatively high degree of specificity of most pathogens, which tends to protect beneficial insects.

Specificity may be a disadvantage as well as an advantage. When two or more species of insects attack a crop simultaneously, it is often necessary to choose a control measure that will control them all.

3. The compatibility of many pathogens with many insecticides, permitting living and chemical materials to be used concurrently.

This is sound if the increased costs are not prohibitive. Since plant disease and insect control are often combined in one operation, we must also consider the fungicides and related materials.

 The ease and inexpensiveness with which some pathogens can be produced.

I have no basis for estimating the relative costs of microbial and chemical insecticides. As already indicated, the cost of producing the milky disease organism has greatly limited its use.

5. The pathogens may be used as sprays or dusts in the same fashion as chemical insecticides.

This may be conceded for many organisms, but it seems quite possible some very highly specialized formulations may have to be developed to overcome desiccation or other weaknesses inherent in some otherwise potentially valuable organisms.

6. The apparent slowness with which a susceptible host develops resistance to a microbial pathogen. As yet there is no authenticated instance of an insect's acquiring a resistance to an introduced pathogen or one directly applied in the field.

This is an optimistic assumption. I am inclined to feel that there is no animal living on this earth today that has not in the course of its evolution developed resistance to more than one pathogen.

We must also recall that insects did not develop resistance to chemicals until we had chemicals so highly effective and so generally used that we forced the inbreeding of survivors.

The fact that pathologists have developed dosage mortality curves for many pathogens and many hosts leads me to believe the inbreeding of survivors might easily result in the development of resistant strains.

7. The low dosages required to kill highly susceptible insects.

This is apparently true of many viruses and perhaps many other organisms, but I dare say some insects for which pathogens have been reported as promising may have rather high dosage rate requirements.

In some cases, microbial insecticides may become self- perpetuating.

Highly commendable when true, but over optimistic and misleading or false claims should be scrupulously avoided.

Disadvantages:

1. The necessity for careful and correct timing of the application of the pathogen with respect to the incubation period of the disease. As living agents, microorganisms often act more slowly than do chemical insecticides; therefore they must be applied early enough to insure that the crop will not be damaged before the insects die.

The last statement implies a false hope. In most cases where a long incubation period is involved or the disease progresses slowly, no timing of treatment could overcome this objection.

2. The relatively marked specificity of most pathogens can limit the spectrum of effectiveness of an organism to only one insect species where several pests are involved, all of which may be controlled by a single chemical insecticide.

This works both ways, As indicated under advantages, sometimes specificity is desirable. If too specific and too limited in usefulness, the product becomes a specialty item that is hard to market.

3. The necessity of maintaining the pathogen in a viable condition, at a high virulence and in a resistant state until the insect is contacted.

A definite problem in some cases, but not in others. Some such problems may be overcome through special formulation or other techniques.

4. The difficulty of producing some pathogens either in large quantities, inexpensively, or both.

In many cases, what now appear to be insurmountable obsta-

(Continued on Page 93)

Zinc Induced Caking in Mixed Fertilizer and Its Counteraction

The incorporation of zinc sulfate monohydrate into a mixed fertilizer, — a practice that is sometimes followed to correct zinc deficiences in an economical manner, is a cause of caking that can become serious in mixtures, such as those of 1-4-4 ratio, that normally exhibit a tendency to cake.

The effect can be satisfactorily overcome with the use of ammoniated superphos-

phate in the mixture, in which case some reduction in the solubility of the zinc salt occurs.

Zinc chelates are also effective as fertilizer additives, with no reduction in the solubility of the zinc. The physical condition of the additive is important in determining the eventual caking character of the product.

CAKING AFFECTS NEITHER THE SOLUBILITY NOR AVAILABILITY OF ZINC

By J. H. Caro, H. P. Greeman and J. H. L. Marshall*

TINC is prominent among the trace elements that are considered essential for optimum plant growth. Its deficiency has for some time been recognized as the primary cause of several common plant diseases, notably mottle-leaf, pecan rosette, and white bud of corn (9). These disorders are now routinely overcome by treatment with soluble zinccontaining preparations applied as a spray on the foliage, a chelate to the soil, or a salt (usually ZnSo4·H2O) applied to the soil or intermixed with the fertilizer. The latter technique effects an economy, as the farmer can apply both fertilizer and zinc in one operation. However, the addition of zinc compounds to mixed fertilizers has been found to enhance their caking tendencies during storage, with consequent reduction in drillability. A study of the causes of this deleterious effect, and investigation of possible means for its elimination were undertaken, and the results are reported herein.

Direction of Investigation

CAKING results principally from the formation in situ of crystals of soluble salts on par-

Fertilizer Investigations Research Branch Soil and Water Conservation Research USDA, Agricultural Research Service Beltsville, Maryland

*Presented at the 75th Annual Meeting of the Association of Official Agricultural Chemists, held in Washington, D. C., on October 12-14, 1959.

ticle surfaces, whereby neighboring particles are cemented together (7, 10). Cementation is promoted by the presence of moisture, which facilitates the dissolution and metathesis necessary for the formation of the binding salt (2). Obvious countermeasures include the addition of an inert conditioning agent, or the control of ambient moisture, but these expedients are not always feasible from an economic or practical standpoint. Preventive efforts in this study were hence directed toward other processing variables that offered promise as possible solutions.

In the case of zinc sulfatesupplemented fertilizer mixtures, containing superphosphate and an ammonium salt, caking could arise from the formation of a soluble zinc salt and monoammonium phosphate in the binding phase according to the reactions: Circumvention or modification of these reactions would presumably counteract the caking directly attributable to the presence of zinc. Measures which were studied include: (a) neutralization of the monocalcium phosphate, through ammoniation, to prevent the first reaction from taking place; (b) processing so that both reactions proceed to completion before the mixture is placed in storage; (c) substitution of zinc carriers other than the commonly used monohydrated sulfate.

Experimental Methods

Seventeen fertilizer mixtures designed to test the efficacy of the different measures were formulated in lots of about one pound, brought to a moisture level of 4.5-5%, and introduced into caking bombs in 3-5 replications of 62 grams each, according to an established technique (2). After storage for one week under a constant pressure of 12 lbs. per sq. in., the caked products were dried at 50° for 72 hours, and the resistance to crushing subsequently determined with use of a cali-

$$\operatorname{Ca}(\operatorname{H}_{2}\operatorname{PO}_{4})_{2} \cdot \operatorname{H}_{2}\operatorname{O} + \operatorname{ZnSO}_{4} \cdot \operatorname{H}_{2}\operatorname{O} \to \operatorname{Zn}(\operatorname{H}_{2}\operatorname{PO}_{4})_{2} \cdot 2\operatorname{H}_{2}\operatorname{O} + \operatorname{CaSO}_{4} \tag{1}$$

 $Zn(H_aPO_a)_a \cdot 2H_aO + 2NH_aNO_a + H_aO \rightarrow Zn(NO_a)_a \cdot 3H_aO + 2NH_aH_aPO_a$ (2)

brated hydraulic press. The mixtures were assayed for phosphorus, zinc, and moisture contents prior to introduction into the bombs and again after the crushing of the cakes.

Formulations and treatments. - Exclusive of two 6-12-12 preparations, the test mixtures were brought to 3-12-12 grade to take advantage of the well-known high-caking character of materials of 1-4-4 ratio. The two exceptions were included to test the influence of larger amounts of soluble salts in the formulation. All the preparations were comprised of the same basic ingredients (Table I), to which additional materials (Table II) were added to form the completed mixtures. Diatomaceous earth was included, in quantities ranging from 120 to 250 lbs. per ton, to bring the mixtures to grade. While it is recognized that variation in the proportion of this filler material might influence the caking character of a mixture, comparisions of zinc-containing formulations with their no-zinc analogs are not affected. Ammonium nitrate was employed as the solid nitrogen carrier rather than the more commonly used ammonium sulfate to avoid the side reaction No. 3 (above). If allowed to proceed, this reaction would engender caking apart from that produced by the primary reaction under study and thus confuse the experimental results,

Individual characteristics of the mixtures are as follows:

Lot No. 1 (Table II) was a simple dry mix of the basic ingredients, serving as a no-zinc reference material.

Lots 1A through 11 were identical to lot No. 1, except that

TABLE I.—Basic Ingredients of Test Fertilizer Mixtures

	Assay		
Ingredient	Component %		
Ordinary			
superphosphate	P_2O_3	20.3	
Ammonium nitrate	N	34.9	
Potassium chloride	K_2O	61.2	
Diatomaceous earth	_	_	

the indicated zinc-containing materials were added.

Lots 2 and 2A were of the same formulation as lots I and 1A, respectively, but were combined in a slurry mix rather than a dry mix. The high density of these materials necessitated the introduction into the bombs of 85-gram rather than 62-gram portions, in order to obtain cakes of comparable volume.

Lots 3 and 3A were the ammoniated analogs of 1 and 1A. respectively. Prior to incorporation into the mixture, the superphosphate was ammoniated in these cases with aqua ammonia to the point of neutralization of the monocalcium phosphate.

Lot no. 3B was formulated to allow for the inclusion of the zinc salt in the ammoniating solution, a possible anticaking measure that provides for the prior completion of reactions involving

Code for Table 2:

1

1

1

1

1

2 2

the zinc carrier. Zinc acetate was the only zinc salt found to possess sufficient solubility in aqua ammonia to be employed in this manner.

Lots 4 and 4A were the 6-12-12 analogs of 3 and 3A, the higher nitrogen content being derived from additions of ammonium nitrate

Analytical procedures.-Total and water-soluble phosphorus and moisture were determined with use of official procedures for fertilizers (3). Water-soluble zinc was found by means of a modified mixed-color dithizone procedure based on known methods described by Sandell (8). The modification allowed for the direct determination of amounts up to 15y of zinc and provided for the removal of all interfering elements normally found in fertilizer mixtures. The procedure is carried out as fol-

Treat 1 g. of fertilizer material according to the official A.O.A.C. method for water-soluble phosphorus (3) and dilute the filtrate to 250 ml. Place an aliquot

TABLE III. - Crushing Strengths of **TABLE II.—Additional Components Cakes of Test Mixtures** of 3-12-12 Fertilizer Mixtures

of No.	Additions to Basic Ingredients ^a , b	Let. No.	Average Crushing Strength of Cakes
1	None		lb./in.2
IA	ZnSo ₄ ·H ₂ O	1	45.4
В	ZnSo ₄ ·H ₂ O	1A	65.1
C	ZnSo ₄ ·7H ₂ O	1B	70.8
D	ZnSo ₄ ·4Zn (OH) 2	1C	38.6
E	Na ₂ Zn EDTA	1D	44.7
F	Na ₂ Zn EDTA (60%)	1E	48.9
G	NaZn EDTA (55%)	1F	62.8
H	$Zn (C_2H_3O_2)_2 \cdot 2H_2O$	1G	76.5
I	ZnNH ₄ PO ₄	1H	44.4
		11	50,2
2	None		1.0
2A	ZnSo ₄ ·H ₂ O	2	218.
		2A	233.
3	NH ₄ OH°	3	9.4
BA	NH4OHc; ZnSO4·H2O	3A	25.2
BB	NH ₄ OH ^c ; Zn- (C ₂ H ₃ O ₂) ₂ ·2H ₂ O	3B	41.1
d	NH ₄ OH ^o	4	28.0
A^d	NH4OH°;ZnSO4·H2O	4A	56.6

Basic ingredients given in Table I.
 Einc carriers added at rate equivalent to
 b./ton of ZnSO₄. Fi.O.
 Aqua ammonia (28% NH₃) added at rate sufficient to neutralise the monocalcium phosphate in the superphosphate.
 Grade: 6-12-12.

of the solution containing not more than 15γ of zinc into a 125-ml. separatory funnel and dilute to 10 ml. with double-distilled water.

Add two drops of cresol redthymol blue mixed indicator, 10 ml. of 10% ammonium citrate solution, and adjust to pH 8.3 (pale rose color) with NH₄OH. Add 5 ml. of 0.01% solution of dithizone in CCl₄ and shake for two minutes.

Transfer the CCl, layer, which contains the metal dithizonates, to another separatory funnel and add 2 ml. of CCl, to the residual aqueous layer. Shake briefly and add the clear green CCl, layer to the dithizone solution in the second funnel. If the CCl, extract is not clear green, additional 2-ml. portions of CCL should be added, shaken, and combined with the dithizone solution until a green extract is obtained. Discard the residual aqueous layer in the first funnel.

Shake the dithizone solution with 20 ml. of 0.02N HCl for two minutes, then discard the CCl, layer.

To the aqueous phase add two drops of brom phenol blue and 10 ml, of a buffer solution prepared by mixing equal volumes of 2N sodium acetate solution and 2N acetic acid, Add 1 ml, of sodium thiosulfate solution (25%) and swirl.

Accurately pipet 5 ml. of 0.01% dithizone solution into the fun-

nel and shake for one minute. Allow the two phases to separate completely, drain a few drops of the CCl₊ layer through the stem of the funnel, and dry the stem with spindles of filter paper. Draw 3.5-4.0 ml. of the CCl₊ layer into a cuvette and measure the light transmittance with a spectrophotometer at a wavelength of 620 m $_{\mu}$. Compare with reference zinc solutions carried through the entire procedure.

Effectiveness of Anticaking Measures

Influence of preparative techniques.-The reference materials containing no zinc (lots I, 2. 3. and 4) exhibited wide variations in the degree to which they caked (Table 3), so that the method of preparation and the composition of the mixtures determine to a large extent the eventual physical condition of the stored material. The influence of zinc-containing additives can therefore be effectively deduced only by direct comparison of zinc-containing with corresponding no-zinc tests. Preneutralization of the monocalcium phosphate by ammoniation of the superphosphate is an effective means of reducing caking, as revealed by comparison of lot 3 (ammoniated mix) and lot 1 (salt mix), the indicated crushing strengths differing by a factor of almost 1:5. On the other hand, addition of solid NH,NO. to raise the grade of the ammoniated mixture to 6-12-12 (lot 4)

caused a decided increase in the crushing strength of the cakes (28.0 vs. 9.4 lb./sq. in.). This is evidently a result of the reaction of the NH₄NO₃ with the KCl in the mixture to form the stable salt pair KNO₃+NH₄Cl (5), both of which have been found in the binding phase of caked fertilizers (10).

The unexpectedly hard cake obtained with the slurry mix (lot 2), an effect also observed by Whynes and Dee (11), bears out the postulation that caking may be caused by mechanisms other than the surficial crystallization of soluble salts (1). Since slurrying allows for the completion of the metathetical reactions that could produce caking, it might logically be surmised that this technique would be an effective preventive. Indeed, in qualitative tests conducted prior to the pressure-bomb experiments, in which the mixtures were stored in a humid atmosphere without application of pressure, the slurried materials did not cake at all. The cake produced in the bombs is thus an obvious result of the application of pressure and bears no relation to chemical reactions occurring within the mixture. One of the caking mechanisms cited by Adams and Ross (1) is the flowing together of crystals under pressure. The fine-grained, highdensity particles produced in the slurry method are ideally suited to pressure-induced crystal knitting, hence the hard cakes.

Influence of zinc compounds.—The addition of zinc to mixed fertilizers as zinc sulfate monohydrate, is a practice normally followed in testing materials, irrespective of the state of the mixture, as shown by comparison of lots 1A, 2A, 3A, and 4A with the corresponding no-zinc mixtures (Table III). [The practice normally followed in the fertilizer industry, brought about considerable supplemental caking in the test.] Lot 1B, which was formulated with use of a different compared to the properties of the state of the state

Preneutralization of monocalcium phosphate by ammoniation of the superphosphate is an effective means of reducing caking. On the other hand, addition of solid ammonium nitrate to raise the grade of the ammoniated mixture causes an increase in crushing strength of the cakes,—due probably to a reaction with potassium chloride to form the stable salts KNO₃ + NH₄Cl, both found in the binding phase of caked fertilizers.

mercial zinc sulfate, also gave harder cakes, so that the caking is probably characteristic of the compound rather than of any individual product.

Substitution of certain other zinc carriers for the monohydrated sulfate eliminated or minimized the zinc-induced caking. The heptahydrate, ZnSO1.7H2O (lot 1C), gave a greatly improved product, despite the reverse expectation from consideration of the solubility of the two sulfates. Another commercial material, zinc sulfatehydroxide (lot 1D), also produced caking no greater than that of the reference material, as did one of the two disodium zinc chelates tested (lot 1E). Two other efficient agents were zinc acetate (lot 1H) and zinc ammonium phosphate (lot 11), both of which are available commercially.

Conversely, other agents and techniques failed to give improved physical condition. A disodium zinc EDTA (lot 1F) and a monosodium analog (lot 1G) produced cakes of the same order of magnitude as the monohydrated sulfate. The inconsistent performance of the disodium salt (lots 1E and 1F) is attributable to physical differences between the two lots

of this carrier. The salt of lot 1E was a free-flowing and coarsely crystalline material, whereas that of lot 1F was comprised of agglomerates of very fine grains and was considerably more cohesive. The monosodium chelate in lot 1G was physically similar to the latter, hence also tended to produce relatively hard cakes. When zinc acetate was incorporated with the ammoniating solution (lot 3B), the physical condition of the product was poorer than in the case of the simple addition of zinc sulfate to the ammoniated mixture (lot 3A), so that this technique is not satisfactory for the purpose.

Compositional characteristics.-Chemical assays of the test materials (Table 4) reveal significant features of the sundry treatments. For example, the fertilizers in which zinc chelates are included (lots 1E, F, G) contain decidedly less water-soluble zinc than those in which other zinc carriers are incorporated. Inasmuch as the element was incorporated in an amount corresponding to 13.7 mg. Zn per gram of mixture, from 1/2 to 2/3 of the chelated zinc is indicated to be water-insoluble under the test conditions.

This lowered solubility could well be influential with respect to the availability to crops of the trace element in some soils, particularly those of high content of organic matter (6). Agronomic experiments showing very high utilization by plants of zinc applied directly to the soil as Na. ZnEDTA (4) imply that the lowered solubility is not harmful, indeed might even increase assimilability by minimizing the reaction of the zinc with soil constituents. Similarly, the zinc-supplemented mixtures that include ammoniated superphosphate (lots 3A, 4A) contain less water-soluble phosphorus and somewhat less watersoluble zinc, hence may also be of slightly different response with respect to zinc assimilability.

In none of the treatments did the caking process change the solubility of the zinc significantly, nor was the phosphorus greatly influenced with respect to its water solubility. The rather wide spread in total P₂O₅ found before and after caking, even with repeated determinations on the same test lots, emphasizes the inhomogeneous nature of mixed fertilizers.

Conclusions

THE incorporation of zinc sulfate monohydrate into a mixed fertilizer, a practice that is sometimes followed to correct zinc deficiencies in an economical manner, is a cause of caking that can become serious in mixtures, such as those of 1-4-4 ratio, that normally exhibit a tendency to cake.

The effect can be satisfactorily overcome with use of ammoniated superphosphate in the mixture, in which case some reduction in the solubility of the zinc salt occurs.

The use of ZnSO₄·7H₂O and ZnSO₄·4Zn (OH)₂, which apart from the monohydrated sulfate are the zinc salts employed most commonly in agriculture (6), is also effective, with no reduction in the solubility of the zinc. Zinc acetate and zinc ammonium phosphate (an auxiliary source of both N and P)

(Continued on Page 95)

Table 4. Chemical Composition of 3-12-12 Fertilizer Mixtures Before and After Caking (a-moisture free basis; b-determined by vacuum desiccation; c-grade, 6-12-12).

Lot No.	Total Pr05a/		H ₂ O-Sol. P ₂ O ₅ 8/ % of total P ₂ O ₅		Moist	ureb/	HgO-Sol. Zna/		
					% of	sample	mg/g. sample		
	Before Caking	After Caking	Before Caking	After Caking	Before Caking	After Caking	Before Caking	After Caking	
	12.5 12.1 12.5 12.5 13.3 12.1 11.2 10.9 12.3 14.0	12.3 11.9 11.6 11.5 12.0 10.9 10.5 11.5 12.0	81.1 80.7 79.2 77.0 70.7 75.2 79.4 83.5 74.0 72.8	79.0 80.2 81.0 86.0 69.7 81.7 80.0 71.3 74.2 72.8	4.6 4.6 4.4 4.4 4.7 4.8 5.8	0.7 0.6 0.9 0.5 0.6 0.8 1.0 1.5 0.8	0.0 12.7 10.1 12.8 4.5 4.6 7.1 10.8 11.5	0.0 12.5 14.1 13.6 5.4 3.0 7.3 11.6 11.9	
2 2A	12.1	==	69.4 78.8		4.2 4.1	=	0.3		
3 3A 3B	12.4 11.9 12.6	11.8 12.7 12.7	58.8 52.1 39.7	60.1 54.3 36.2	4.5 5.0 4.4	0.5 0.3 0.8	0.0 9.8 2.4	0.6 8.1 3.2	
اعما	12.0	12.2	63.3	56.5 56.5	4.2	0.6	0.0 9.8	0.0	

Entomologists Exchange '59 Research Results

- DDT Tonaphene Synergistic on Cotton Boll Weevil
- Co-Rul, Ronnel Effective in Screw-worm Control Programs
- " No Satisfactory Control Found Yet For New Muscid Fly Pest
- Housefly Resistance to Hydrocarbons is Now World Wide

Conclusion of Agricultural Chemicals report of annual ESA meeting held November 30-Dec. 3rd, 1959 at Cadillac Hotel, Detroit, Mich.

OMMENTING on highlights of 1959 research on medical and veterinary entomology, W. C. McDuffie, USDA, observed that two outstanding insecticides - Co-Ral and ronnel (Korlan) have been developed for control of screw-worm and have been used effectively in the recent control programs. Co Ral is effective as a .5% spray or 5% dust applied all over animals. A 1% dust of Co-Ral and a 5% smear of ronnel are excellent wound treatments. Both these insecticides are far better than the old remedies EQ-335 and smear 62.

Regarding grub control in cattle, Dr. McDuffie remarked that Ruelene is the only new systemic in an advanced stage of development. Dow Chemical Co., he said, has obtained considerable data on this material during the 1958-59 grub season, and it is being tested extensively by other groups this year. "It may not be superior to ronnel and Co-Ral, but it has the advantage of being effective by several means of administration."

House flies and mosquitoes continue to be one of the most serious problems in pest control, continued Dr. McDuffie. "Certain of the organic-phosphorus insecticides are still giving satisfactory control of these pests, but resistance to them is increasing, and this class of insecticides may soon be ineffective in many areas." Re-

sistance in certain species of Anophelise mosquitoes to the chlorinated hydrocarbons continues to handicap the World Health Organization's campaign to eradicate malaria. However, there have been two developments which may solve the problem, at least temporarily. First, malathion has been shown to be a satisfactory substitute for DDT and dieldrin for the residual treatment of dwellings. And second, the Public Health Service has found that DDVP is highly effective as a residual fumigant. Small bags of this insecticide, strategically placed in homes, produce enough toxic vapor to kill resting adult mosquitoes.

Dr. McDuffiie reported on the increasing problem of controlling a muscid fly, Musca autumnalis that has become abundant and is causing serious annoyance to cattle and horses. Aside from the annoyance it causes, this species is considered a potential spreader of pink eye of cattle. J. G. Matthysse, who has been conducting studies of this pest, reports that methoxychlor, pyrethrum, and various other living stock insecticides caused a temporary reduction in populations, but did not provide satisfactory control. Other insecticides, and particularly repellents are being investigated to cope with this problem.

Cotton Pest Control Reports

CEED treatment is probably Othe most important way in which Thimet is presently applied to cotton for insect control," according to an address by D. A. Lindquist, J. Hacskaylo and T. B. Davich, USDA, who presented data from tests designed to study the rate and amount of Thimet absorbed by germinating cotton seed under various germinating conditions. The tests showed that the major portion of Thimet absorbed by the cotton plant from seed treatment occurs during the week immediately following planting. "Since previous work has shown that Thimet does not translocate from one cotton leaf to another in insecticidally active amounts, it is obvious that the failure of Thimet seed treatment to control boll weevils in the field for more than three or four weeks is caused by the plant not absorbing the toxicant in sufficient quantities over an extended period of time."

Another set of tests on the amount of absorbed Thimet necessary to prevent germination of cotton seeds and/or subsequent emergences of cotton plants, was not conclusive. The study did show however, that the intact seeds that did not germinate absorbed less than one-half the amount of Thimet than did the seeds that did germinate.

USDA investigators, D. A. Lindquist, J. R. Brazzel and T. B. Davich, stated that "Within the past few years the boll weevil has become economically resistant to chlorinated hydrocarbon insecticides in some cotton growing areas; toxaphene is one of these insecticides which fail to control resistant boll weevils." They continued to state, however, that "a combination of two pounds of toxaphene plus one pound of DDT per acre gives adequate control of resistant weevils when properly applied. DDT alone has never given satisfactory boll weevil control." The researchers reported on this apparent synergistic effect, and cited data showing that slightly more DDT remained on the cuticle of weevils treated with DDT alone than on the cuticle of weevils treated with toxaphene and DDT. Data of other tests indicated that toxaphene did not affect either the absorption or metabolism of DDT by the boll weevils sufficiently to cause the synergistic effect of the mixture of DDT-toxaphene.

"Resistance to chlorinated hydrocarbon insecticides in house flies is now world-wide," observed G. C. LaBrecque, USDA, who reported that failures to maintain control with organophosphorus compounds are becoming more and more prevalent. The carbamates and other groups of compounds have given some promise of restoring a satisfactory degree of control. Tests with methotrexate, one of the most active of 200 compounds tested, caused sterility in females, but not in the males . . . and Mr. LaBrecque indicated further consideration would still be given the compound.

Reporting on tests to determine the effect of gamma irradiation on the boll weevil, T. B. Davich and D. A. Lindquist, USDA, advised that treatments of 5,000 to 20,000 roentgens to adult boll weevils caused 50% mortality in 7 to 10 days. A dose of 2,400 roentgens resulted in no apparent damage to boll weevil pupae; although 1200 roentgens drastically reduced egg hatch; 5000 to 10,000 roentgens caused transient sterility in male weevils, 15,000 roentgens caused complete sterility.

Biological Control

NEED for extended research A into the understanding and use of organisms that nature provides to maintain a biological balance of life has been brought into sharp focus by the increasing awareness of the limitations of chemical control methods, advised C. H. Hoffman, USDA, in outlining the approaches to biological control. "Among successful attempts to control an insect by biological means were those against the Japanese beetle. Imported parasites and native disease organisms complemented each other to control destructive populations. Tipha vernalis has parasitized over 60%

of the Japanese beetle grubs." Another outstanding example in control of the Japanese beetle has been the use of pathogens, specifically the milky disease bacteria Bacillus popillae Dutky and lentimorbus Dutky. Grubs, pupae and adults are subject to infection. The bacteria are now widely distributed in the eastern United States, and are believed to have an important role in holding the beetle population to a fairly low level.

Mr. Hoffman reported that over a period of 30 years, more than three million parasites of the European corn borer have been imported from Europe and the Orient, and equal numbers reared in the U.S. have been released for control purposes. Of 24 species imported and colonized, six have become established. The parasitization has ranged from 25 to 50%. However, in some restricted localities, Lydella grisescens has parasitized as many as 90% of the borer population. In general, observed Mr. Hoffman, parasites have provided partial control of the borer in areas where they have become established.

Continuing the discussion on cotton pests, Mr. Hoffman remarked that at least 16 parasites of the pink bollworm have been brought into the United States, but they have not become established. The releases were made in a semi-arid region where cotton is irrigated and where few alternate host plants used as a control measure eliminated most of the hosts as well as the parasites before hibernation. Stages of the pink bollworm for parasitization are available only during 2 months of the vear. The absence of alternate hosts to bridge the intervening period probably wiped out the parasite colonies.

Stability of Pesticide Residues

(CW HENEVER residues are mentioned, two thoughts come to mind: (1) if it is to be effective, an insecticide residue must at some time be of sufficient magnitude to kill the insect involved; and (2) by the time the

Members of the ESA board of governors (left to right): Dale R. Lindsay, Bethesda, Md.; A. Steinhaus, Univ. of California; R. W. Sherman, USDA, ARS; E. H. Littooy, Colloidal Products; F. W. Fisk, Ohio State Univ.; J. E. Bussart, Velsicol Corp.; H. M. Harris, Iowa State Univ.; M. P. Jones, USDA; R. H. Nelson, ESA; P. W. Oman, USDA; Roy Hansberry, Shell Chemical Corp.; O. I. Snapp, USDA; L. D. Newsom, Louisiana State Univ.; E. G. Linsley, Univ. of California; C. B. Philip, Rocky Mountain Laboratory; and Neely Turner, Connecticut Experiment Station.



crop is harvested or grazed, it must be at or below a level considered safe for human or animal consumption,—as the case may be", such was the observation by Dr. George C. Decker, Illinois Natural History Survey, in commenting on the stability of pesticide residues in relation to plant protection. Dr. Decker also observed that although data is available showing the amount of residue present at intervals after an insecticide is applied. since learned that with cooler weather, the rate of heptachlor loss is reduced, and the amount of epoxide formed is greater, and the peak is not reached until the third day. It might be even longer under still cooler conditions. In the soil, the peak is not reached for several weeks or even months."

In a further discussion of residues, Dr. Decker cited various situations where demands on residues are quite different: in grasshopper

Considerable investigation is still required to obtain data relating insecticidal efficiency to magnitude of residues on plants at various periods following application to specific crops.

"we have very little data that will enable us to relate insecticidal efficiency to the actual magnitude of residues on plants, measured in terms of milligrams per square centimeter, or ppm."

Studies have shown that insecticide sprays applied to mature apple and peach foliage tended to disappear in a given order, which seemed to be related to their reported vapor pressures. By plotting the log of the residue against arithmetic time, said Dr. Decker, researchers can compute RD values. Also, if environmental factors and growth remain constant,—one can predict the number of days to reach a specified tolerance or other value.

Persons in the pesticide industry are often asked how long after spraying will residue levels reach a specific tolerance level. Dr. Decker noted that if growth is a factor, the answer will depend on the stage of growth when the chemical is applied. "Most of you," he stated to the 1000 entomologists at the meeting, "are familar with our work on epoxidation of aldrin and heptachlor,-but you may have drawn the erroneous conclusion that epoxidation reaches its maximum within 24 hours. That was true under the high temperature conditions that prevailed. We have

control, for example, persistent residues are desirable, since re-invasion is frequently a problem; in a complex ecological system, a pesticide is desired which will do the job on the pest species as quickly and effectively as possible, and then dissipate with a minimum of damage to parasites, predators, and other desirable species. There may also be cases, continued Dr. Decker, where we would like to have a strong insecticidal effect to eliminate more mature forms of pests that are usually more difficult to control, and still leave a small persistent residue that will kill newly hatched forms as they appear (for example: soil treatment for the control of subterranean species). Thus, concluded Dr. Decker, we find that epoxidation of aldrin and heptachlor, which in some instances is a liability, becomes an asset.

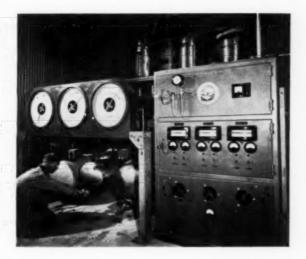
Memorial Lecture: Pathology

The 1959 Memorial Lecture honored Charles Valentine Riley (1843-1895), and was presented by Edward A. Steinhaus, University of California. It dealt with "Insect Pathology: Challenge, Achievement, and Promise". Dr. Steinhaus indicated that "although not an insect pathologist, Dr. Riley was interested in the diseases of insects,

and in their possible use in the control of insect pests." Dr. Steinhaus observed, "There is every indication that the promise of insect pathology is great and substantial. we have only begun to exploit entomogenous microorganisms and their products. Several immediate possibilities in this area are suggested. Microbial control should and will be pursued in its own right, but the future will also see it integrated with other forms of control. Industry should broaden its perspectives so as to engage in and support active research on biological insecticides of all types, Among the most promising developments on the horizon are the extensive use of insect viruses once methods of mass producing them are achieved. Certain groups of fungi, protozoa, and nematodes also have great potentialities in this respect after a large amount of essential basic research is accomplished. In the long run, one of the most important developments in applied insect pathology will probably be the successful introduction of insect pathogens into populations of destructive insects so as to exert extended and longterm control.

In commenting on the effectiveness of chlorinated hydrocarbon insecticide mixtures for control of resistant boll weevils, J. R. Brazzel, Texas Agricultural Experiment Station, reported that the addition of DDT to toxaphene increased its toxicity to susceptible weevils slightly, – synergistic effects, on the other hand, were evident when the mixtures were applied to the resistant strain.

Specifically, DDT alone controlled 30% of the boll weevils, regardless whether they were susceptible or resistant (9 to 150 micrograms/ per boll weevil was tried); with toxaphene alone, 80 to 90 per cent control was obtained against the susceptible variety, but only 20-30% against the resistant variety. Definite synergistic effects were noted against the resistant boll weevils when DDT and toxaphene were combined.**



Prentiss Opens Pyrethrum Unit

by Donald A. Davis

NEW TYPE UNIT FIRST TO BE INSTALLED IN THIS COUNTRY

A NEW type pyrethrum extraction unit, which makes use of a triple distillation process, has been put into operation by Prentiss Drug & Chemical Co., New York, at its Newark, N. J., manufacturing plant. This unit, said to be capable of turning out 20% high-grade colorless pyrethrum extract is expected to give Prentiss added market strength in selling to formulators of household and agricultural pesticides.

The process, which is the first installed in this country, was built by Prentiss on a license arrangement from Cooper, McDougald, & Robertson, Ltd., Berkhamsted, Herts, England, the developer of the process. It is also, the first such unit built in this hemisphere and is the first constructed anywhere "from the ground up." All the equipment except refrigeration units used with condensers was imported from England, including a 12-foot-wide instrument panel from The Stabilag Co., Ltd., Hemel Hemsted.

Main function of the plant is careful distillation of the raw pyrethum extract, a heat sensitive material, so as not to destroy the active insecticidal ingredients. The raw extract, which is taken from pyrethrum flowers grown in Kenya and the Congo, is introduced into the Prentiss unit just as it arrives from the African extraction plants—as a pitch—like flowing substance. This raw extract contains substantial portions of hexane and other petroleum fractions products, which have been introduced in the Africa plants to act as the liquid vehicle for the material.

This petroleum fraction is distilled off in the first of a series of three stills, which are arranged so that specific components are removed under successively higher vacuum (and at successively higher temperatures). All three of the stills are large stainless steel units, equipped with complicated grill-like electrical heating units. As the liquid petroleum fraction is separated in the first still, it is pumped to a storage tank for later use as the vehicle for the highly purified pyrethrum concentrate.

The second stage takes care of what Prentiss chemists call "precutting". The material remaining from the first distillation is heated further (to about 175° C. against the 130° in the first still) and from it is extracted a material that has a substantial percentage of pure pyrethrins in it.

The remainder of the material in the second still is then moved

on to the third and last unit, which heats it to 230°C. to extract a light yellow material which is very high in pyrethrins content.

By careful mixing of the product of second and third distilling processes, together with the petroleum fraction distilled first, a material in color from yellow to white can be obtained—with no apparent sacrifice of toxicity to insects.

The 12-foot instrument panel shown in the accompanying photo is an integral part of the whole process, for it keeps an accurate measurement of temperature in the three stills and of the weight of the raw material tank, of the tank used for the petroleum fraction, and of the tank into which the final product is pumped. Every ten minutes a check and listing of the entire panel is made, to permit Prentiss technicians to keep a tight control on the entire process.

According to Ronald McIntyre, of Cooper, McDougald, & Robertson, who erected the unit for Prentiss, the three-stage system is necessary because of the heat sensitivity of the raw material, "It should be emphasized," he declared, "that this is not a true molecular distillation, but rather a combined 'sweating out' of speci-

(Continued on Page 92)

A PPROXIMATELY 1,000 orchardists and others interested in the fruit industry gathered in Wenatchee for the 55th annual meeting of the Washington State Horticultural association Dec. 7 to 9. Speakers from various parts of the United States and British Columbia brought information on latest developments in pesticide use and other phases of producing and marketing high-quality fruit.

By flying to Australia this fall, Dr. L. P. Batjer, USDA principal "Aminotriazole is a valuable tool. It is a highly effective herbicide. It definitely has a place in weed control, but that place is not in your orchard!"

Dr. Telford related that the 1960 spray recommendations for commercial orchardists in eastern Washington will advise against the use of chemical herbicides around fruit trees because of potential danger to the trees and of possible harmful residues in fruit produced later.

shell form develops, because it does not do well against the adults. This was the observation of Everett Burts, entomologist, Tree Fruit Experiment station, Wenatchee.

He warned d'Anjou growers that a severe infestation of psylla following harvest will definitely limit next year's crop, so the pests must be controlled with postharvest sprays. Guthion and Sevin were suggested as materials to use.

Dilan, a chlorinated hydrocarbon, which works more slowly than the other two materials, has proved highly effective, Burts added. It has a zero tolerance, so must be used pre-bloom or postharvest. It is one of the safest to use as far as its effect on honeybees is concerned, the speaker added.

Mites developed as much as a 200-fold increase in resistance to Kelthane this past season, Ford H. Harries, USDA entomologist with headquarters in Wenatchee, revealed when the panel discussed these pests. It was the McDaniel species from certain apple orchards in north central Washington that proved resistant, he added.

Growers who are still obtaining good results with Kelthane should continue to use it, the panel agreed. Several other miticides are under test, but results with some are variable. Tedion has proved effective, but at the time of the meeting, no tolerance had been established by the Food and Drug Administration, it was brought out.

Time spent in looking for mite build-up in the orchard is well invested, Stanley C. Hoyt, Tree Fruit Experiment station entomologist, commented. Very little time is required to keep watch, and a great deal of money will be saved by doing so, he declared.

Russetting on Golden Delicious this past season was blamed generally on poor drying weather when the sprays were applied, although it has been established that a virus ailment is the cause of a ring-spot russet. Sevin applied before the latter part of May caused

WASHINGTON HORTICULTURISTS CAUTIONED AGAINST USE OF UNAUTHORIZED PESTICIDES

"Our tree fruit industry cannot afford adverse publicity such as that suffered by the cranberry producers" —Telford.

plant physiologist stationed at Wenatchee, was able to pack two years' experience into one, he told the growers. "Down under" he continued his tests with Sevin to learn the most effective concentration and timing of the insecticide for its plus value as an early fruit-thinning spray. Earlier tests in apple orchards in Washington had demonstrated that Sevin had this quality up to about a month following full bloom.

Residues of various types came in for more than the usual amount of discussion during the convention.

"The sensational and illadvised press releases on aminotriazole and cranberries have focused national attention on pesticide residues and have unquestionably damaged the cranberry industry," declared Dr. H. S. Telford, chairman of the department of entomology at Washington State University. "Our tree fruit industry can ill afford such adverse publicity. To guard ourselves from such a calamity, don't use pesticides which are unauthorized.

Guthion Controls Pear Psylla

Codling moths were controlled more easily this past season, but pear psylla were not, various entomologists who addressed the horticultural association agreed. Cooler weather in the spring and early summer provided the psylla with favorable conditions for a rapid build-up.

"There is no doubt that Guthion was far above any other insecticide we tried against psylla," Fred Dean, USDA entomologist stationed at Yakima, Wash., commented during a panel discussion of apple and pear pest control.

Failure of growers to determine the stage of psylla they were combatting often caused the orchardists to blame the materials being used, Ezra Crist, Wenatchee fieldman for Skookum Growers, Inc., brought out.

Ethion was almost as good as Guthion in controlling psylla, but it is not on the market yet, Dean added. Sevin will do an effective job in killing psylla nymphal instars, but it is imperative that the material be applied before the hard about 13% russet on Goldens, one speaker declared.

Bee Loss Critical

Losses suffered by beekeepers this past season have been critical, E. B. Purchase, Wapato, president of the Washington State Beekeepers' Association, declared. There is a serious question whether members of the association can afford to bring bee colonies into the orchard country, he added.

About one fourth of the colonies in the lower Yakima Valley were killed completely and the remainder entirely demoralized and badly weakened. The honey averaged only 10 to 15 pounds per hive, Purchase declared. The worst poisoning developed after the bees had been removed from the orchards, but there is a critical period following tree fruit blossoming when food for bees is limited. At that time they will fly several miles in search of blooms and may be poisoned by spray materials that have dripped onto the cover crop, it was brought out.

Up to 90% of the bees used in orchard pollination service in the state of Washington come from the Yakima Valley, Carl Johansen, Washington State University assistant entomologist, told the orchardists. Cool, rainy, windy weather during late May and early June—between petal fall in the orchards and the time alfalfa seed crop bloomed—made the 1959 season "particularly tough," he declared.

Addition of a bee repellent to spray formulations was suggested. Johansen reported that R-874 looks promising and may be recommended in the future. He suggested that orchardists mow or beat down their cover crop before applying Sevin, dieldrin or phosphate insecticides, and that they advise beekeepers when to remove bees to a different locality.

Dusts are always more hazardous to bees than are sprays of the same material, Johansen declared, Guthion and Sevin are suggested as post harvest sprays to control pear psylla in 1960. Ethion is almost as effective as Guthion, but not yet on the market.

adding that dieldrin emulsifiable has a shorter residual toxicity than does dieldrin wettable powder.

Control of Stone Fruit Pests

Control of stone fruit pests was outlined by Edward W. Anthon, Tree Fruit Experiment station entomologist, who combined suggestions for protecting bees with his advice on sprays. The two best times to spray for peach twig borer are pre-bloom and petal fall stages, he pointed out. If the spray is delayed until petal fall, the orchardist should be sure all petals have dropped.

However, the peach twig borer is becoming more difficult to control in the state of Washington, according to Anthon, and sprays delayed two or three weeks after petal fall are too late to be effective. Formerly it was suggested that a shuck spray be applied, but the jacket is shed by young fruits over such a long period that it is confusing.

If the peach twig borer has not been controlled with the early sprays, Anthon suggested that an additional spray with an acaricide should be put on the latter part of May or the first part of June.

"Because of the difficulty in controlling this insect, the time is past when one can skip a spray, apply it improperly, or time it poorly and still get satisfactory results," he declared.

"Experiments the last three years have proven that DDT at 2 pounds of 50% wettable powder plus 1 pound of 25% parathion wettable powder in 100 gallons of water still give good control when applied properly," he went on. "Other materials which have given satisfactory control are dieldrin, 1 pint; oil, 1 gallon plus DDT 2 pounds; Sevin, 2 pounds; Guthion, 1½ pounds, and Diazinon, 2 pounds per 100 gallons of water."

Green peach aphids were present in greater numbers than ever before in the past 12 years in the Wenatchee area, Anthon reported. The pest has demonstrated in yearly experiments since 1953 that it has become resistant to standard organo-phosphorus sprays. This was even more evident during the past season, because of the extended time they stayed in peach orchards before migrating to other host plants.

Anthon tested 17 insecticides and 50 different insecticide combinations to control the green peach aphids. Good results were obtained with nicotine, ½ pint plus 1 quart Volck Supreme oil; Phosdrin, 1 pint; Thiodan, 2 pounds. However, the latter has not been approved for use on fruit trees, and it does not have a fumigating action, so it must be applied before the leaves are curled to provide satisfactory control.

From 800 to 1000 gallons of spray are needed per acre, and the spray must be driven into the curled leaves to contact the aphids, Mr. Anthon pointed out.

Insecticide dusts are more hazardous to bees than are sprays of the same material. Dieldrin emulsifiable has a shorter residual toxicity than does the wettable powder.

Failure of growers to apply insecticides when the pest first appears makes control of San Jose scale difficult, he declared in reporting on 20 treatments in a severely infested prune orchard. The following materials applied in the delayed dormant gave the best control: Volck Supreme oil used alone at 2 gallons, or 1 gallon in combination with one of the following: Trithion, 1 pint, or Diazinon, 1 pound, or parathion, 1 pound. Ethion-oil combination at 2 gallons also gave good control.

Freezing temperatures occurred shortly after the sprays were applied, and trees receiving 4 gallons of dormant oil treatment were severely injured, while weakened trees sprayed with 1½ gallons of Volck Supreme oil showed some injury. However, trees in better condition did not show injury even when 2 gallons of Volck Supreme oil was used. The amount of injury seemed to be correlated with

where the tests were conducted, Sprague added. There was some injury with Captan applied at this strength.

A light scab infection developed on McIntosh sprayed with ferbam at 5X (about 12 pounds per acre). Sprague suggested that DDT be omitted when using Cyprex at 5X concentration.

Allied Chemical's 2466 showed some promise against scab in the plots where used in north central Washington, but needs further testing under more severe conditions, he observed. Scab carry-over was light in the area, and early sprinkling dissipated ascospores that did come through the winter.

"Our control with ½ pound Cyprex was against a very light infection," he went on. "Cyprex at that rate would have protective value, but in using it against all but the lightest of infections where we wait until it rains, I would suggest the 34 pound rate.

Failure to apply insecticides when San Jose Scale first appears makes control of this pest difficult—Best control has been obtained with formulations containing Trithion, Diazinon or Ethion. Allied Chemical's 2466 shows promise against scab, but needs further testing under severe conditions.

the condition of the tree, Anthon observed.

Kelthane will control all species of mites in Washington stone fruit orchards, he added. Cyprex appeared effective in controlling apple scab if applied up to 48 hours after rains start, Roderick Sprague, Tree Fruit Experiment station plant pathologist, reported. No material shows eradicative action beyond that time.

Captan ground application also gave good control, but applied after 48 hours it did not. Cyprex applied at 5X with a Beskill sprayer caused no injury to fruit or foliage of Jonathan, Delicious or Golden Delicious in the orchards "There may be cases where the 1-pound rate might be economical if, for instance, long rains prevented betting into an orchard within the 48-hour limit. If you follow a protective schedule, the ½ pound rate of Cyprex will prove about equal to our standard protective schedules.

"If the rainy period comes when lime-sulfur is still usable, it is equally effective at 3 gallons per 100."

Apple mildew plots have been maintained for 11 seasons in a solid block of Black Jonathans at the Tree Fruit Experiment station, Sprague commented in telling of some fairly clear-cut results obtained during 1959. Mildew was plentiful, with cobweb russetting of fruit running as high as 67% on unsprayed trees.

Karathane at ¾ oz. plus 2 oz. of a wetter-sticker gave very good control when four sprays were applied at 10-day intervals starting April 10. Karathane EC, a 50% active-ingredient liquid, was as effective at the 6 oz. rate as the ¾ oz. 25% standard dry Karathane, and did not require an additive. Plyac, Ortho Spray sticker and B 1956 were used as stickers.

Polysulfide compound gave good control in a three-spray schedule starting April 10 and spacing at three-day intervals. Dilute sulfurs at 1 and 2 pounds rated poor and mediocre in control, while an ammoniated polysulfide compound caused some leaf injury.

Niagara 5943 at ½ pound per 100 appeared to be one of the most efficient materials tested against mildew, according to Sprague, but it is somewhat dangerous to the operator. The antibiotic Phytoactin needs further testing, and other new materials did not show much promise, he commented.

Batjer, in reply to a question in the question-answer period preceding one of the sessions, commented that pre-harvest applications of drop-prevention materials will be governed in effectiveness by atmospheric conditions. The abscission layer which forms where the stem joins the branch is stronger when dry.

If a rainy period follows application of the pre-harvest spray, it will tend to hasten the fruit drop.

E. J. Newcomer, Yakima, retired USDA entomologist, was elected president of the association; Doyle B. Starcher, Chelan, Wenoka fieldman, first vice president, and Arthur Enbom, Yakima grower, second vice president. Dr. John C. Snyder, Pullman, Washington state extension horticulturist, was re-elected secretary-treasurer.

WASHINGTON REPORT

By Donald Lerch



EVERYONE in Washington is watching for more fireworks on the chemicals-in-foods front during this session of Congress. HEW Secretary Arthur S. Flemming's handling of the cranberry situation just before Thanksgiving focused public attention on chemicals. It also set off a chain reaction.

Already being talked about here are: 1) demands by some groups that inspection and clearance of the purity of farm commodities be vested solely in USDA instead of being shared with FDA as at present; 2) demands by some Congressmen to give FDA more power to ban chemicals alleged to have ill effects upon humans; and 3) requests by HEW for more funds to expand FDA's research facilities and to improve FDA's policing of food producers and processors.

The final outcome is not assured, but many observers here feel the most likely result will be either an uneasy stalemate until a new Congress is elected or a vote to give FDA more power and money. One bill now being shaped up would ban from use on foods any chemical FDA designates as a carcinogen even though no residue of the chemical is likely to remain in or on marketed food.

Support for giving FDA more money already is being expressed by such consumer-oriented groups as the AFL-CIO, the Consumers Union, and the General Federation of Women's Clubs. Though it is not generally known, FDA has been keeping in close touch with consumer opinion for a number of years through consumer consultants in FDA's 17 field districts,

To further improve the use of this consumer consultant network, FDA has announced appointment of an Administrative Officer specifically for Consumer Programming in FDA. Significantly, the new Administrative officer is a women with a public relations rather than a technical background. This indicates even closer ties between FDA and homemakers are in the offing.

Obviously, farmers and chemical companies, as much as anyone else, want pure foods. What is worrying farm leaders, however, is that farmers' interests might suffer unnecessarily in future FDA actions as they did in the cranberry affair, and to a lesser extent in the action taken against poultry. Their fear is that despite subsequent reassurances on the purity of cleared food products, initial FDA accusations dominate the news stories and shake consumers' confidence in the products involved.

Since FDA now has close ties with consumer groups, some farm leaders and industry men are expressing the view that further efforts must be made to educate the public to the benefits of chemicals in modern food production and processing, a formidable task in dealing with millions of people to whom chemistry is a complete mystery.

You can depend upon one definite outcome as far as pesticides are concerned. There will be an even greater effort by FDA, USDA, and the agricultural chemicals industry on the "read and follow label directions" program. The Farm Division, National Safety Council, will stress "read the

label" in its safety campaigns this year.

Industry leaders continue to emphasize that if the weedkiller involved in the cranberry affair had been used according to label directions, the present crisis could have been avoided.

Late last month, Secretary Flemming said that he will ask for more leeway in regulating the use of cancer-causing chemicals in foods when he appears before congress to recommend that the "cancer clause" of the Food Additives Act also appear in proposed color additive legislation.

He said that the cancer clause, which bars from foods any additives found to cause cancer, op vates unfairly. When a drug which produces cancer in laboratory animals can be fed to livestock without leaving residue, Mr. Flemming said, it should be considered safe. Meticulous tests have shown that no residue was left in meat from stilbesterol fed to livestock.

You may have overlooked this, but USDA's Agricultural Research Policy Committee has reaffirmed their conviction that chemicals are essential in modern food production and approved the USDA's new research on pest control methods reported in this column last month.

Reflecting a new appreciation of the power of consumers, the Committee stressed that consumers as well as producers have a big stake in strengthening research relating to the use of chemicals in agriculture.

What is needed in addition to more research, the Committee indicated, is the development of better understanding among people generally of the problems in agriculture. Without that understanding, consumers could inadvertently ban some practices or products which might cripple food production as well as food producers.

.

Unlimited markets for pesticides and fertilizers are available for those willing to promote products overseas. This is the view of a few Industry leaders here who are taking the long view. They point to the fact-that agriculturally underdeveloped countries around the world are now seeking to boost living and eating standards. At the same time, populations are exploding under their noses. This means an increasing demand for the most effective food production boosters—pesticides and fertilizers.

In a significant new development, the Food and Agriculture Organization of the United Nations will soon launch a worldwide "Freedom From Hunger" campaign, According to present plans this campaign will stress the theme that the world is now on a starvation diet and more must be done to increase crop yields.

A major factor in boosting yields, says FAO, is chemical control of destructive farm pests. Many countries overseas already have set up or are organizing national agencies to promote pest control. FAO's five-year "Freedom From Hunger" campaign can be expected to speed up this trend.

Pesticide and fertilizer manufacturers are more likely to benefit from this program than farm equipment manufacturers. Experts in foreign agriculture tell us that the biggest need is not for mechanization. Man-power is plentiful. What is needed in countries such as India, Indonesia, Colombia, and Brazil are better seeds, more fertilizers, more pesticides, and the know-how to use them effectively. Both NAC and NPFI report a recent increase in requests for information from farm leaders overscas.

Reports coming in to Washington from these areas indicate that communicating the necessary know-how to overseas farmers is an essential key to unlocking the door to vastly increased foreign use of both pesticides and fertilizers.

There are some favorable domestic side effects which may come from the FAO's campaign. One is a shift of the general public's thinking away from U. S. farm surpluses toward the need to further increase food production efficiency. The other is greater public understanding of the vital role pesticides and fertilizers play in producing adequate amounts of safe, wholesome foods needed by our own growing population.

Wildlife, agricultural, and pest control interests are "laying it on the line" as they discuss differing viewpoints and objectives at a special meeting in Washington at the National Academy of Sciences. Chief aim is to find areas of agreement and develop constructive programs around them. Those familiar with the controversies and future areas of conflict applaud the statesmanship behind this meeting. It is felt that Dr. Herbert E. Longenecker will use his position as chairman of the conference to effectively resolve some of the varying viewpoints. Dr. Longenecker is vice president, Chicago Professional Colleges, University of Illinois, and a friend of longstanding among many in this industry

While much of the discussion will revolve around the use of chemicals, many resource people are reaching the conclusion that wildlife interests must modify some of their positions in order to keep in step with the tremendous population growth expected during the remainder of this century. The plain facts are, there just won't be enough land to go around unless it is used constructively and cooperatively. Hunting is cited by resource experts as one of the best examples. One of the latest reports show that 85 per cent of all hunting is done on private lands. Unless the hunters who cause problems can be educated — resource people expect a large part of this land to be closed to hunters by farmers.

Consequently, the question of conservation use is really much broader than the involvement of agricultural chemicals, important as this is.

The meeting is open for discussion by all parties and no fixed agenda is being followed. The agricultural chemicals industry is being represented by Lea S. Hitchner, Executive Secretary, NAC.

Greater use of application of pesticides and fertilizers is being predicted for Europe as the result of the formation of a European Agricultural Aviation Center located at The Hague, Netherlands.

.

Aerial applicators from 11 European countries from Turkey to the United Kingdom are now supporting the center to step up the study and promotion of aerial application in Europe.

Of interest to members of the National Aviation Trades Association and the National Agricultural Chemicals Association is the announcement that future issues of the Center's quarterly publication will report on chemicals which can be applied by air, and progress in aerial application in the U. S. A.

No one is yet predicting the total fertilizer sales for 1960, but the National Plant Food Institute is doing its share in arming fertilizer salesmen with tools to do a maximum selling job.

More than 100 fertilizer company representatives took part in NPFI's Fertilizer Promotion Workshop in Iowa. NPFI staff members were pleased with the enthusiastic reception given to the workshops, and plan one more—a Northeast Workshop at Hershey, Pa., January 21.

Idea behind the promotion sessions is to present useful college information, soil testing, demonstrations and other techniques for

(Continued on Page 91)

Book Reviews

BRIMSTONE – The Stone That Burns, 308 pages. By Williams Haynes. Published by D. Van Nostrand Co. Illustrated. \$5.95.

This is the second edition of a volume first published in 1942, telling the story of the American sulphur industry from the early prospecting in the Gulf Coast area, through the pioneering with the Frasch process, the more recent development of the industry in Mexico and the current and future prospects for expansion of sulphur mining into Canada and France. Of particular interest to the sulphur buyer are the two concluding chapters, Brimstone Today—and Tomorrow.

Nobody doubts, the author points out, "that sulphur will be in oversupply for the next few years." However, lower prices in this market do not have the normal effect of increasing sales. All uses of sulphur, Mr. Haynes observes, "depend on the activities of a multitude of industries which buy no more nor less than they need as a chemical tool." A lower price thus may cause a switch in source of supply, but will not result in any increase in overall demand. On the other hand, there is no tendency on the part of the seller to dump stocks, since sulphur can be stored indefinitely with no appreciable deterioration. The ability to hold sulphur in stock without loss discourages distress sales.

It is estimated that by 1975 U. S. consumption of sulphur will reach over 10,000,000 long tons, as compared with the 1950 figure of 4,806,000 tons. A 200% increase is anticipated in the use of sulphur in the production of ammonium sulphate and a 130% increase in manufacture of superphosphate. The greatest increase in consumption, it is anticipated, will be in fertilizers and chemicals.

France, which until recently imported substantial tonnage of

sulphur (335,000 tons annually) is now able to satisfy all demand from local production and is prepared to export as much sulphur as it used to import. A Canadian industry has also been built over the past few years, and by the end of 1958 there were six plants producing at the rate of 290,000 tons of sulphur a year. Seven additional plants were planned for completion in 1959. Another future source of recovered sulphur will be found in the Middle East where there are extensive sour gas fields.

The price of sulphur is determined on the top side by the cost of producing sulphur from pyrites, which source still supplies between one-third and one-half of the world's sulphur requirements today. The floor below which sulphur prices cannot fall is fixed by the cost of operating enough high-cost producing units, (domes with high water ratios) to supply the market demand. During the past 25 years, incidentally, the cost of sulphur has risen only about 30%, while labor costs, taxes, gas, pipe, etc. have risen on the average in the neighborhood of 200 to 300%.

Much of the early history of the industry is covered in a highly interesting fashion in Mr. Haynes' book, with tributes to the contributions made to the development of the industry in the United States by Herman Frasch, who invented the hot-water sulphur mining process. Also covered are the history of the Union Sulphur Company which he founded, Freeport Sulphur Company which in 1912 challenged Union's domination of the domestic sulphur industry and Texas Gulf Sulphur Company which, as a third strong competitor for the American market, launched an effective educational campaign throughout the fertilizer industry, and has been responsible in a major way for the big expansion in use

of sulphur by the American fertilizer industry over the past thirtyfive years.

The Scientific Principles of Crop Protection, by Hubert Martin (Director, Science Service Laboratory, Canada). Published by Edward Arnold, Ltd., London, U.K. 359 pages. 4th Edition (1959). \$12.50.

Owing to the remarkable development of chemical pesticides and fungicides since the third edition of this authoritative book in 1940, the publishers have felt it necessary to bring out a thoroughly revised edition. The author describes fully the tremendous developments in the list of chemicals that are now available to the farmer for the protection of his crops. The subject is complex. It involves biological, chemical and physical studies. The author's purpose, as briefly stated, is to assist the cooperation among entomologist, mycologist and chemist by analyzing the principles which support modern methods of controlling the enemies of man's

This book is recommended to the professional investigator, student and agriculturist. The exposition of basal principles and their application to the pesticides are clear and instructive. It should be available in every library.

VINCENT SAUCHELLI

Subtropical Fruit Pests, published by the University of California's Division of Agricultural Sciences, contains in one volume both a comprehensive technical survey covering hundreds of subtropical insects and an up-to-theminute practical guide to the control of insect pests on subtropical fruit crops. The author is Walter Ebeling, professor of entomology at the University of California, Los Angeles.

As a reference book and practical guide, Subtropical Fruit Pests is intended for use by entomologists and agriculturalists with state and federal agencies, university scientists, chemical companies, pest control operators, etc.

"Plant Pathology: Problems and Progress 1908-1958." The University of Wisconsin Press, Madison, Wis. XIX + 588 pages, 1959. Price \$8.50.

This book is the product of 51 authors, five editors, and the American Phytopathological Society. It is, in fact, the Society's Golden Jubilee volume. It collects the major addresses and symposium papers presented by some of the world's most noted scientists before the 50th anniversary meeting of the Society at Bloomington, Indiana in August 1958.

Thus, "Plant Pathology" is a broad treatment of the science. It contains something to interest every biologist, not only for plant pathologists, but also for specialists in such related sciences as genetics, physiology, and biochemistry; and indeed, there is much for young students of biology.

The book has an important place in the literature of plant pathology and of other biological sciences. Carefully, and to a degree philosophically, it develops the history of plant pathology and projects its future.

The book is in ten parts. Each part is devoted to a major division of the science. Most of the book—parts two through ten—contains the papers presented before the nine symposia of the anniversary meeting. There are six papers on physiology, seven on genetics, seven on fungicides and the chemistry of fungicides, six on fungi, five on nematology, eight on the structure and the multiplication of viruses, and five on epidemiology.

The authors of these papers are among the most distinguished in their own fields. For example, G. J. M. van der Kerk, of the Institute for Organic Chemistry, The Netherlands, contributes a paper on the "Chemical Structure and Fungicidal Activity of Dithiocarbamic Acid Derivatives," and Gerhard Schramm, of the Max Planck Institute for Virus Research, Germany, discusses "The Role of the Nucleic Acid in the Infection with Tobacco Mosaic Virus."

It is significant that these two contributors came from foreign lands. Twenty-one of the 41 papers included in the symposia were presented by scientists from England, Australia, South Africa, Germany, The Netherlands, Honduras, Mexico, and Canada.

Part One of the Golden Jubilee volume contains the seven major addresses concerned with the history and development of plant pathology. Again, the prestige of the authors and the quality of their papers are outstanding. E. C. Stakman of the University of Minnesota relates plant pathology to the world's scientific and social development; John A. Stevenson of the United States Department of Agriculture traces the development of the science in North America; and I. G. Harrar of the Rockefeller Foundation discusses an international approach to the study and control of plant diseases. Other contributors to this section are S. E. A. McCallan and George L. Mc-New of the Boyce Thompson Institute of Plant Research, J. C. Walker of the University of Wisconsin. and James G. Horsfall of the Connecticut Agricultural Experiment Station.

All in all, Plant Pathology reflects much credit on the various committees of the Society that were responsible for the presentation and publication of these papers, the contents of which point to the significant role of biological sciences in the future of mankind.

PAUL MILLER

Colorimetric Methods of Analysis, Vol. 11A, by F. Dee Snell, Cornelia T. Snell and Chester A. Snell. Published by D. Van Nostrand Co., Inc., Princeton, New Jersey. 793 pages (1959). \$15.00.

An up-to-date compilation of colorimetric and photometric methods of analysis culled from the literature of the past decade. Volumes I to IV of this series contained such methods as had appeared during the period 1948-1954. Every chemical analytical laboratory library and analysts also

should have this valuable 68chapter compendum of methods spelled out in detail. Also included are chapters describing improvements in laboratory equipment and instruments, together with hundreds of helpful formulas, tables and illustrations.

The senior author is a chemist of high competence in this profession, and president of the well-known firm of consulting chemists bearing his name. The other two authors are both known among their colleagues for their contributions to the advancement of analytical chemistry.

VINCENT SAUCHELLI

The Chemical Warfare Service: Organizing For War, by Dr. Leo P. Brophy and Col. George J. B. Fisher, published by the Office of the Chief of Military History, Department of the Army, Washington 25, D.C. 498 pages, price \$4.

The 41st volume published in the series, United States Army in World War II, Organizing for War is the first to be published in a group of three Chemical Corps volumes in the subseries, "The Technical Services."

Although mainly concerned with munitions, Chemical Warfare Service cooperates with other branches of the Army, with the U.S. Public Health Service, and with the Navy on projects of a quasi-public-health nature. In 1920, for instance, the service cooperated with the Medical Department and the Quartermaster Corps in the extermination of rodents and vermin. Later the CWS worked on methods of exterminating the boll weevil and on improved methods for fumigating ships.

As its title implies, this first volume traces the organization and administration of the Chemical Warfare Service from its origins in World War I up through World War II and deals with the training of military personnel for offensive and defensive chemical warfare in the same period.

TECHNICAL SECTION



Effect of Insecticides on Arthropods in Alfalfa

CPRAYS containing parathion, malathion, demeton, endrin or toxaphene applied to alfalfa caused marked reductions of the total arthropod populations. Reductions were greater for the phytophagous species as a group than for the entomophagous species. The toxic effects of some of the insecticides to certain insect predators created favorable conditions for their prev which became more numerous later on in the sprayed plots than in the untreated checks. The residual effects of all of the above were quite limited due to migration into or between plots. At the dosages used, namely 3 pounds toxaphene, 1/2 pound malathion, and 1/4 pound each of parathion, endrin or demeton, - toxaphene was generally less effective than the others. Parathion was the most toxic to some of the beneficial species and endrin was the least toxic.

Effects of all insecticides on certain species:-When it was possible to identify a species, and it was sufficiently numerous, the effects of the insecticides on it were evaluated by population changes. Here it must be pointed out that migration into or out of the plots. the effects of unfavorable weather conditions and the interaction between a host and its natural enemies all cause population changes. Thus the best chance of determining the effects of insecticides on the species present came within a few days after the plots had been treated.

Hippodamia convergans: All insecticides reduced adult populations over the checks, parathion causing the greatest reduction. Demeton and endrin were less toxic than either parathion or toxaphene. No effects were observed on the larval populations.

Collops quadrimaculatus (Fab.): All materials reduced populations when this species was present in sufficient numbers to analyze the data.

Melanoplus biluturatus (Walker): Because of the strong flight powers of the adults, only data on the nymphs were taken. Toxaphene and endrin were very effective and residual. Other materials failed to reduce populations because of continued hatching of the eggs in the various plots.

Lygus lineolaris (P. deB.): Malathion was effective against nymphs and adults in the large scale test. No significant changes were noted in the small plots.

Nabis alternatus (Parshley): Parathion and malathion were the only toxic materials against this species.

Orius insidiosus (Say): Endrin, toxaphene, parathion and demeton were very toxic.

Therioaphis maculatus: Parathion, demeton and endrin caused marked reductions; toxaphene was less effective in one test. There is evidence that this species increased in the large scale experiment because malathion killed great numbers of the convergent lady beetle.

Macrosiphum pisi: Biological control masked the direct effect of the insecticides on this species, but population increases were recorded in plots sprayed with parathion, toxaphene and demeton. Populations remained lower in the plots sprayed with endrin than in the checks.

Aceratagallia uhleri: Parathion, demeton and endrin were very effective; toxaphene less so.

Empoasca fabae (Harris): Parathion, demeton, and endrin were quite effective.

Chrysopa sp.: Population differences between treated plots and checks were not statistically significant.

Effect on the Diptera, Hymenoptera, and Araneida.—No evidence was found that any of the materials reduced fly populations. None of the insecticides had any measurable effect upon the populations of entomophagous Hymenoptera. There was also no relation between the numbers of spiders collected and spray treatments.

F. A. Fenton, "Effect of Several Insecticies on the Total Arthropod Population in Alfalfa." Journal of Economic Entomology, pp. 428-432, Vol. 52, No. 3, June, 1959.

New Phosphoric Acid Process

Mitsubishi Chemical, Mitsubishi Petrochemical and Tohoku Fertilizer of Akita, Japan, are planning pilot tests of a new phosphoric acid process developed by Professors Keiichi Murakami and Soichiro Hori of Tohoku University. Details of the new method are not available, but some U. S. experts feel it may involve a counter-current treatment of phosphate rock to produce a lean acid solu-



PRODUCTS AND SERVICES FROM IMC

- Phosphate Rock
- Triple Superphosphate (Coarse, Granular, Run-of-pile)
- · Phosphoric Acid
- Muriate of Potash (Coarse, Standard, Granular)
- Sulphate of Potash
- · Sul-Po-Mag

Manufacturing and Technical Service
Transportation Service
Customer Service
Management Services
Marketing Services

IMC marketing service includes special promotion material imprinted with customer's brand name.



Determined to help customers sell their products and earn more profit, IMC makes available total marketing assistance through its sales representatives. In effect, your IMC man is a

MAN WITH A MISSION

Your IMC sales representative offers you valuable assistance in marketing your products at a profit. He recognizes the need for selling cooperation between you, the fertilizer manufacturer, and IMC, the supplier of fertilizer materials. And with that recognition, he has a personal interest in doing everything he can to help you build product volume.

For example: the Planalyzer that simplifies charting sales activities twelve months in advance. There's also the farmer-dealer kit which includes practically every sales aid you need to hold a successful farmer-dealer meeting. How to advertise and promote your product is outlined in a down-to-earth manner in a 68-page booklet.

Other ways he helps include how to determine the potential of your market and how to find prospects . . . how to select and assess your salesmen. Still other IMC helps give you promotional material imprinted with your brand name... crop packages, fertility charts. Transportation is vital in IMC's marketing program... new methods and techniques that help lower your costs and provide a variety of assistance in handling and moving finished goods or ingredients.

But going beyond this, IMC has presented sales sessions aimed specifically at training fertilizer manufacturers' salesmen in more effective methods. The program covered ten principal cities and is further supported by sales assistance at your plant for your individual salesmen.

This total marketing service is unique . . . expressing the full-function assistance of a full-line company. It is geared to apply in all phases of your operation — nitrogen, phosphorus or potash — through total technical service, research, merchandising.

Your IMC representative can bring this total service to you, and help you plan for higher profit. Just give him a call.



Products for growth

AGRICULTURAL CHEMICALS DIVISION

INTERNATIONAL MINERALS & CHEMICAL CORPORATION

Administrative Center: Skokie, Illinois

Help in lining up materials, talks, and facts for meetings is part of IMC's marketing assistance. Market analysis aid is another important service from IMC's Man With a Marketing Mission.



tion. Economic advantages claimed for the new process are believed to depend on direct use of the lean acid (without the costly operation of concentrating the acid) in fertilizer manufacture, and on sale of the by-product gypsum.

Fruit Moth Control

Investigations conducted at the Ohio Agricultural Experiment Station, Wooster, O., have shown that Sevin (1-naphthyl N-methyl carbamate) (Union Carbide) gives better control of the oriental fruit moth than standard materials such as DDT and parathion. In addition to giving excellent control of fruit moth, this product is reported effective against the plum curculio, stink bugs and plant bugs. It does not, however, control orchard mites.

Low toxicity is another attractive feature of this new product. The safety factor is reflected in the use restrictions formulated by the Pesticide Regulation Section of the USDA. These regulations prohibit the application of DDT within 30 days of harvest, and parathion within 14 days of harvest, but allow the application of Sevin the day before harvest.

Because of the relatively high cost of Sevin at the present, this material is commercially recommended only in the fifth cover spray, which is timed from two to three weeks before harvest. The recommended dosage is two pounds of the 50 per cent wettable powder in 100 gallons of water. Sevin has good residual properties, which allow considerable flexibility in timing the fifth spray. For example, it can be used, and its application timed in such a way that late varicties will be sprayed two to three weeks before harvest, while earlier varieties in the same block can be sprayed at the same time, even up to the day before harvest, without violating the use restriction.

Fritted Fertilizers Studied

Fertilizers made from glass are now being used in Florida to prevent rapid leaching from the soil, according to H. W. Winsor, assistant chemist with the Florida Agricultural Experiment Station. Mr. Winsor, who had been working with boron, studying the causes of its rapid leaching, searched for a less soluble form of the material. Other scientists were fighting the same problem.

After a nationwide search, silicates were deemed the nearest natural answer to the problem. But little of the material was found in natural glasses. Finally one company began making a glass fertilizer which contained one or two of the minor elements. All six of the minor elements can be incorporated into this product, including boron, copper, iron, manganese, molybdenum and zinc.

According to Mr. Winsor, 25 to 50 pounds of the glass fertilizer, called frit, per acre has produced excellent results. Plants bloom freely, set seed heavily, and produce larger yields of higher quality plants when glass fertilizer is incorporated into usual fertilizer mix.

Trithion Controls Chinch Bug

Two years of research at the Florida Agricultural Experiment Station indicated that Trithion will give satisfactory control of chinch bugs in St. Augustine grass. Dr. S. H. Kerr, assistant entomologist, says the new material does not supersede previous recommendations, but merely is added to the list of effective controls.

Trithion is reported to control chinch bugs in parts of Florida where DDT now has little effect. One of the three phosphatic pesticides should be used by home owners for best results in chinch bug control in the southern part of the state.

Dr. Kerr says DDT can still be used successfully in North Florida. The results with DDT in the middle part of the state seem to be erratic. If any control difficulty is encountered, use a phosphatic compound, advises the entomologist.

Trithion has a dangerous level of oral toxicity. Very little needs to be taken into the body through the mouth to cause poisoning. The danger of poisoning through skin adsorption is considerably less. Since principal contact with pesticides for lawn use is by skin contact, Trithion is judged sufficiently safe for handling by home owners.

90' Dryers for Fertilizer Prod.

ICI, England, recently purchased two dryers of the parallel flow single shell type, 12 ft. in diameter by 90 ft. in length, to be used in the production of fertilizers. The dryers along with four ball mills and two coolers were supplied by Head Wrightson Stockton Forge, Ltd., England.

To handle situations when the material might become sticky, "Knockers" are provided near the feed ends of the shells to assist in prevention of accumulations of material in this area. There are four pneumatically operated "knocker" units controlled by electrically driven rotary valve units. Discharge of oversize material is achieved by radical lifters through a central cone outlet.

One of the coolers is 12 ft. in diameter by 75 ft., and the other 11 ft. in diameter by 70 ft. Arranged for counter flow, they will handle similar materials to the dryers.

Controls Tobacco Moths

Pyrethrum mists and aerosols are effective in killing tobacco moths in tobacco warehouses, but only partially control cigarette beetles, according to a research report issued last month by the U. S. Department of Agriculture.

The report stated that neither pyrethrum mists nor aerosols are as effective as fumigation, but they can be used in loosely constructed warehouses where fumigation is not effective.

Based on a report by R. W. Rings in Ohio Farm and Home Research, May-June, 1959, pp. 38-39.

Controlling Tobacco Moths

Pyrethrum mists and aerosols have been used extensively in to-bacco warehouses and factories for the control of the tobacco moth and the cigarette beetle. Both types of treatments are highly effective against the moth, but have proved to be relatively ineffective against the beetle.

Fumigation is more effective than mists and aerosols for controlling the cigarette beetle, but mists and aerosols are useful for controlling insects in loosely constructed building where fumigation cannot be used.

In tests carried on by Joseph N. Tenhet of the USDA's Stored-To-bacco Insects Laboratory at Richmond, Va., a highly refined, very volatile hydrocarbon oil proved quite satisfactory. Heavy oils were undesirable because they left an objectionable greasy deposit in to-bacco warehouses. Synergists for pyrethrum, when used as a contact insecticide, appeared to be of little value against the cigarette beetle.

Concentrations of insecticide in the mists and aerosols should be 0.2 per cent pyrethrins for control of tobacco moth, and one per cent for the cigarette beetle. When using mists, the insecticide should be applied at the rate of three fluid ounces per 1,000 cubic feet of air space, and for aerosols at 2½ to three fluid ounces. Applications may be made daily if necessary.

Study DDT In Water

The behavior of DDT in water influences its effectiveness in killing mosquito larvae, according to U. S. Department of Agriculture scientists who have found that the chemical rushes to get out of suspension in water, either by evaporation or by clinging to the walls and bottom of containers.

This previously unknown action of DDT was discovered by USDA entomologists at Orlando, Fla., in their attempts to determine why simple mosquito resistance tests in laboratories failed in some instances to provide reliable data. They found that, within two minutes after mixing in one part of DDT to every hundred parts of water, as much as a third of the DDT had migrated to the walls and bottoms of the containers. Further, in 24 hours more than half the DDT, long known for its persistence and non-volatility, had evaporated, Similar tests with other insecticides, Parathion, Malathion, Lindane, and Dieldrin—did not show this action.

Field tests are being contemplated to see if changes in the manner of using DDT will lead to more effective results, the scientists said.

Systemic Soil Miticide Injected

Recent experiments show that mites on mature apple trees can be controlled by injecting systemic miticides into soil under the trees with a device designed by a U. S. Department of Agriculture entomologist.

Field trials conducted in two Indiana orchards by Merrill L. Cleveland of USDA's Agricultural Research Service, in cooperation with Purdue University, showed that soil injection of Thimet, an organic phosphorus compound, effectively reduces mite populations.

In both orchards, however, Thimet applied to the trees as a spray was somewhat more effective than when injected into the soil. No harmful effects were noted on any of the trees receiving the injection treatment.

As no device was available to test the soil-injection method, Mr. Cleveland developed an injector that operates from a conventional high-pressure orchard sprayer by attachment to the spray hose in the same manner as a spray gun.

The injector consists of a 4-foot piece of $\frac{3}{4}$ -inch pipe into which is placed a 4-foot section of $\frac{1}{4}$ -inch pipe. The two pipes are welded together, closed at one end, and that end shaped into a point through which a small hole is drilled to the inner pipe. Water forced through this hole allows the injector to move into the ground with little effort.

The outer pipe has several holes near the point through which the miticide solution is forced, once the injector has been inserted about 3 feet into the ground. A "Y" valve on the hose permits the closing of one pipe and the opening of the other.

In one orchard, the systemic was diluted at the rate of 12 ounces per 100 gallons of water and injected at the rate of 36 gallons per tree, 9 gallons at each of 4 locations. In the other orchard, a similar solution was injected at the rate of 120 gallons per tree, 10 gallons at each of 12 locations. Soil injection of the miticide was effective at both rates.

R-H Herbicide Literature

The Reasor-Hill Corp., Jacksonville, Ark., has prepared a group of folders on its R-H Weed Rhap-20, a ready-to-use herbicide

HIGHLIGHTS ON WEED CONTROL RESEARCH PROJECTS

- For weed control in beets, the most effective herbicides were reported by a Pennsylvania investigator to be Endothal alone at 9 and 12 lbs., Endothal with TCP at 10 lbs., Monuron at ½ and 34 lbs. and Randox at 9 lbs./acre.
- In soybean plantings in Delaware, excellent control of broadleaves was obtained with NaPCP at 25 lbs./acre. Satisfactory results were obtained with Premerge at 6 lbs./acre. Emid at 2 lbs./acre was called promising for control of broadleaves and grasses.
- Silvex was the most satisfactory herbicide used to control chickweed in lawns in tests conducted in Maryland. Liquid CIPC and DNBP were also satisfactory. Henbit was best controlled by Silvex, DNBP and KOCN, respectively.

WHY IT REALLY COSTS LESS TO GET THE BEST,

A SELLERS

Swathmaster

Yes, you may be able to get a dust spreader and spray system for less than the cost of a Swathmaster, but what about those other expenses?

- NO time is lost on your Swathmaster airplane to convert it from dust to spray or back again for the next job. A Swathmaster is ready any time to dust, spray, seed or fertilize!
- LESS maintenance effort is required to service or clean your Swathmaster than needed for a spray system with its additional mechanical parts such as pumps, screens, valves, plumbing and nozzles. Less down time means more profitable applicating hours.
- FEWER airplanes mean less capital investment, maintenance, insurance and general overhead. One pilot and one Swathmaster equipped airplane will do the job of one pilot and two airplanes (a duster and a sprayer).



NOTE THE SHARP CUTOFF OF DUST AFTER THE PILOT CLOSES THE SWATHMASTER GATE AT THE END OF A RUN.

Swathmaster Applicating Rates:

Dusts, 10-60 lbs./acre at 50 ft. swaths
Pellitized fertilizers, 100-1,000 lbs./acre at 48 ft. swaths
Light alfalfa seed 5-30 lbs./acre at 66 ft. swaths
Rice, 150-500 lbs./acre at 40-48 ft. swaths
Liquids, 1-180 gallons/acre

- Swathmaster can dispense high or low density dry materials; solutions, emulsions and suspension liquids; some of the new invert (jelly) emulsions without streaking and at a wide variety of flow rates.
- IN THE LONG RUN you pay less for a Swathmaster because you get a precision built dispenser, job proven to give you dependable and trouble free service.

Our free brochure tells how the Swathmaster will increase your profits. Write or phone for it today.

MANUFACTURED AND DISTRIBUTED BY

TRANSLAND



AIRCRAFT

2600 W. 247TH ST. . TORRANCE, CALIFORNIA . PHONE DAVENPORT 6-8110

ALSO DISTRIBUTED BY

SELLERS AVIATION INC.

1515 CRESTMONT DRIVE BAKERSFIELD, CALIFORNIA PHONE: FAIRVIEW 2-5184

AGRICULTURAL CHEMICALS

AGRICULTURAL

Applicator

- Spray Demonstration in India Tata-Fison sponsors a demonstration of helicopter spraying for small plots in India sugarcane areas.
- Fumigant Application Methods
 A comparison of existing methods of applying nematocides for root knot control







SPRAY DEMONSTRATION

Tata-Fison Shows Helicopter Spraying In India For Pyrilla Control On Cane

ALTHOUGH commercial aerial spraying of crops by a fixed-wing aircraft has been going on for the past five years in India, it was not until last summer that a helicopter was used for the benefit of agriculture in that country.

In a joint venture by Tata-Fison-Private Ltd., Bombay, and the Department of Agriculture of the Government of Bombay State a helicopter spraying operation was carried out in a major sugarcane growing district in the Deccan area of central India for Pyrilla control. Aerial spraying of sugarcane by fixed-wing aircraft has been found to be effective and economical in India, but the services of the Government of India's Plant Protection aircraft have not been available to the small farmer and, due to the difficulty of spraying small areas with airplanes, only the large sugar mills which own extensive sugarcane plantations in the Deccan have been able to employ aircraft. The main object of

Tata-Fison's spraying program, therefore, was to determine the possibilities of using the helicopter for the smaller farm holdings, the majority of which are between five and 50 acres.

Normally, the small farmer has had to accept fatalistically the Pyrilla insect infestations because the cost and extreme difficulties of penetrating the very thick-growing sugarcane make ground spraying almost impossible. In instances where ground application of insecticides was available to the farmer, it normally took about 30 men to do an acre of sugarcane per day.

Farmers who witnessed the demonstration, therefore, were distinctly impressed with the helicopter which could provide efficient and economical coverage at the rate of 20 acres in six minutes.

The interest aroused in the area was considerable, according to Tata-Fison. Not only big estate owners in their cars and station wagons were on hand for the demonstration, but small farmers and their families travelled considerable distances in bullock carts where they had seen the helicopter operating. These same farmers had seen airplanes spraying the crops of their larger neighbors, but this demonstration was the first opportunity they had to see how an aircraft could help them.

Ten acres of Pyrilla-infested sugarcane were sprayed by the helicopter for the demonstration. They belong to Nivruthi Balwant Girme, owner of a rich sugarcane farm of 20 acres in the Deccan.

Reporting on the demonstration, Mr. Girme writes that he was very much impressed with the helicopter which can spray even small fields effectively. Because a fixedwing airplane requires a landing strip and farms without trees for its work, as it has to fly low, he said, we have been unable to take advantage of aerial spraying up to now. Mr. Girme explained that



individual farmers can not afford to provide landing strips nor do they wish to cut down mango and other trees on the borders of their farms, which often provide them with extra income.

The helicopter, Mr. Girme said, can land anywhere and can spray small areas despite trees. Besides, he pointed out, the insecticide filling operation can be done adjoining the field, in any open place where water is available. Another factor in the helicopter's favor, according to Mr. Girme, is that the farmer has an opportunity to talk to the pilot before he starts operations and can explain to him the crop area to be sprayed.

J. R. Mody, marketing manager for Tata-Fison, reporting on the demonstration, said that, contrary to expectations, the helicopter is able to provide an economic service, even to the small sugarcane grower, and helicopter spraying should become a successful venture in India. **

Facing page: the Hiller 12C helicopter used for the demonstration was transported by truck to Ahmed-nagar, about 150 miles east of Bom-Because of bay. rough roads from there on, the helicopter was flown to the sugarcane field. Left photo shows helicopter taking off directly from the truck at Ahmednagar Loading takes place unon its ar rival at field to be sprayed (right). Helicopter skims tops of sugarcane (above) during

(above) during spray runs and lands for reloading operations near spectators (right) providing them with their first chance to see an aircraft up close.





Ouring our past spray season we operated three different types of new agricultural aircraft. Without a doubt the Ag-Cat hauls a bigger load with much more safety than the other two; and made us more money than any agricultural airplane we have ever owned. 1,500 lbs. in the Ag-Cat is a breeze!

Mr. Joe Jones, Texas Dusting Service, Rio Hondo, Texas

Contact the Ag-Cat gave us the best defoliating job this season we have ever had, and its total operating cost is about 25% less. On 10,000 acres of flying we spent only \$64.00 for maintenance.

Our work consists mostly of dusting apple orchards and blueberries; mouse baiting orchards; spraying row crops and mosquito work. The Ag-Cat has given us 41% more acres per hour using 52% less fuel.
Mr. Alden E. Robinson of Aero Spray and Dust Service, Accord, New York



No doubt about it—the Grumman AG-CAT is one sweet baby to do business with!

The Ag-Cat, designed specifically for the agricultural operator, has the simplicity, ruggedness, reliability and safety you need. As a result of its superior flying and handling characteristics, pilot fatigue is virtually eliminated. This means both pilot and Ag-Cat owner safety and, therefore, represents a form of insurance not available through any insurance company.

Designed for quick turn-arounds, the Ag-Cat does the job of two airplanes, spraying and dusting, and can be converted from one to the other in minutes. Its hopper capacity is certified for 1,200 pounds; all rigging is external; metal surfaces are corrosionproofed; components are easily accessible and it has dozens of other outstanding features.

Grumman Ag-Cats are at distributors now and are available for flight and field testing. And now available, the Grumman Finance Plan, the simplest payment plan yet devised; a plan which still allows you to deal through your own bank.

For more detailed information on the Grumman Ag-Cat and the new Grumman Finance Plan, contact the distributor nearest you.

GRUMMAN AG-CAT GRUMMAN AIRCRAFT ENGINEERING CORPORATION

Bethpage

Long Island

New York

U.S. DISTRIBUTORS

Magnolia Aviation Co. Laurel Airport Box 683 Laurel, Mississippi French Aviation Co. 1849 Airport Drive Bakersfield, California Sun Valley Dusting Co. P. O. Box 1671 San Benito, Texas Mid Continent Aerial Sprayers & Dusters, Inc. Hayti, Missouri



Hahn Introduces '60 Hi-Boy High Clearance Sprayer

Hahn, Inc. Evansville, Ind., is offering nine 1960 models of the Hahn Hi-Boy self-clearance sprayers. The Hi-Boy is designed for the application of liquid fertilizers and herbicides and for thorough spraying of all crops through every stage of growth.



New improvements on Model H-300 shown here include a boost in horsepower to 30 and maximum speed to 20 mph; increased tank capacity to 200 gallons; and a heavy-duty frame designed to permit full clearance of plants as machine goes through field. Also new are the "full-slope" fenders with no sharp edges that permit the Hi-Boy to travel through rank growth

To Address CAAA Meeting

Jay A. McCausland, General Operations Branch, Bureau of Flight Standards, Federal Aviation Agency, has been added to the list of speakers for the 10th annual convention of the California Agricultural Aircraft Association at El Mirador Hotel in Palm Springs, Jan. 14-16.

Mr. McCausland will discuss the decision of Congress to have the FAA write a set of regulations for aerial applicators. The Bureau of Flight Standards believes that the best way to fulfill the FAA responsibilities for the protection of persons and property on the ground from aircraft and chemicals dispensed from aircraft is to establish regulations providing for an "Air Agency" certificate for aerial applicators. This Air Agency certificate would provide minimum standards for equipment, facilities, maintenance, and personnel operating under appropriate flight and maintenance regulations. Mr. Mc-Causland, who announced this action by Congress at the NATA meeting in New Orleans, has been added to the CAAA program so that he can personally present the information to the California operators.

Other features of the CAAA meeting will be a panel discussion of problems presented by members from the floor, and a presentation by Lloyd Nolen, NATA vice president for agriculture, of a set of colored slides to be used in giving talks before civic groups and others for the betterment of public relations.

Claude Finnell, Imperial County (Calif.) agricultural commissioner; Dr. Ralph Fogleman, an authority on chemical injury to animals; John Neace, Neace Aviation, Litchfield Park, Ariz.; and Robert Z. Rollins, Calif. Bureau of Chemistry, also will be among the speakers at the meeting. An airshow-type demonstration of agricultural aircraft and equipment will open the meeting.

12th Custom Spray School

The 12th Custom Spray Operators' Training School will be held Jan. 26 to 28 in the Illini Union Building, University of Illinois, Urbana. The first day will be devoted to meetings of the Agricultural Spraying Association and the Illinois Aerial Applicators' Association.

Among the topics to be discussed in the training school are: recent revisions in the Illinois Weed Law; insect control with soil insecticides; toxicology studies on Amino Triazole; and new weed chemicals.

In addition: reports will be presented on regular vs. liquid herbicides; face flies on cattle; pesticide contamination of milk; and crop desiccants.

The insect situation in Illinois will be the subject of a report, as will equipment for applying granular herbicides. Other discussions will cover weed control in Illinois farm ponds and the progress of Sevin as a chemical for corn earworm control. Recent state legislation affecting the use of 2,4-D and systemic insecticides for hessian fly control will be reviewed at the school.

NATA Appoints Robert Monroe Executive Director



Robert E. Monroe

THE National Aviation Trades Assn. has appointed Robert E. Monroe as Executive Director to fill the vacancy created by the death last year of Charles A. Parker, Mr. Monroe who has been acting executive director for the last six months, has been with the NATA national office for one and one-half years. Prior to joining NATA, Mr. Monroe had been in the aviation business in Prescott, Arizona and Bozeman, Montana.

At its annual convention in New Orleans, Nov. 17-20, the NATA elected as its president for 1960, K. V. Brugh Jr., president of Greensboro-High Point Air Service, Greensboro, N. C. Among other officers elected were Richard Reade, Mid Continent Aerial Sprayers, Hayti, Mo., vice president-membership, and Lloyd P. Nolen, Mercedes Dusting Service, Mercedes, Texas, vice president-agriculture.

Seven regional vice presidents also were elected at the meeting. (Continued on Page 92)



PIPER - Pawhee

MODEL PA-25

HERE, at last, is an agricultural airplane designed from scratch to meet the requirements of the vast majority of aerial applicators. Here, at last, is an Ag

plane embodying a long list of design features deemed desirable from years of government, industry and university research. It's the Piper Pawnee, practically priced, economy-designed, safety-engineered to give the aerial applicator a safe, efficient, profit-

Designed under the direction of Fred E. Weick, Director of the Piper Development Center, the Pawnee best meets the all-around

requirements of the custom applicator. Don't make a move until you see, fly, dust or spray with the Pawnee. This hard-working

able airplane.

DESIGNED WITH
THE PILOT IN MIND!

BIG, ROOMY COCKPIT



RAISED COCKPIT FLOOR

Plus these other important safety features: Rearward Cockpit Location • Unobstructed Vision • Outward Bending Longerons • Simple, Direct Fuel System • Wire Cutters • Overhead Deflection Cable.

A FEW OF THE

airplane is the one for YOU!

1100-pound useful load; 2300-pound gross; big 20cubic foot, easily removable fiber glass hopper; quick, simple conversion for dust or spray; large quick - opening inspection panels; rugged 150 hp Lycoming engine

with hinged motor mount; tough Piper Duraclad covering . . . just a few of the design features to assure dependable operation, economical maintenance, backed by world-wide Piper service and readily available parts. See your Piper dealer or write for brochure, Dept. 1-M.

PIPER AIRCRAFT CORPORATION · Lock Haven, Pennsylvania

-

WORLD'S LEADING BUILDER OF AGRICULTURAL AIRPLANES

JANUARY, 1960

61



Figure I. Constant gravity-flow fumigation equipment for inthe-row treatment. This unit is designed to handle two rows at a time. The fumigant is deposited at a depth of eight or nine inches.

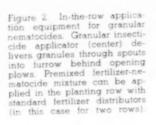
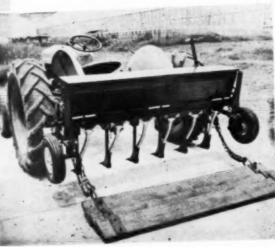




Figure 3. Constant gravityflow solid fumigation equipment equipped with chisels for applying liquid fumigants on 12-inch centers to a depth of eight to ten inches.



Figure 4. Small grain drill (or fertilizer spreader) adapted for solid application of granular nematocides by adding fertilizer spouts and points



SATISFACTORY control of root-knot nematodes in the past apparently has been achieved with soil treatments of granular DBCP (1,2-dibromo-3-chloropropane adsorbed on Attaclay granules), even though many methods of using this material have not been very effective and most of the methods have not been compared experimentally for efficiency with the standard techniques of chisel injection of liquid nematocides.

Among the methods commonly used are: applying the granules with a fertilizer spreader and working them into the soil with a disk harrow or other equipment; row treatment with a fertilizer-DBCP mixture placed under the row at varying depths according to the size of the seed to be planted; and side dressing for row crops or perennials.

The number and variety of application methods, and the doubtful efficiency of some of them, indicated that, if the material was to be used most advantageously, some evaluation would be necessary and standards of performance should be established. A study to this end was conducted jointly by the United States Agricultural Re-

Methods of Application For Nematode Control

search Service and the Georgia Agricultural Experiment Station. The results of this study were reported by J. M. Good and A. E. Steele in the *Plant Disease Reporter*, Oct. 15, 1959, 'Evaluation of Application Methods for Applying 1,2-Dibromo-3-Chloropropane for Control of Root Knot'.

Tifton loamy sand with a light to moderate infestation of the root-knot nematode was used for the test. Eight soil treatments, replicated six times, were set up in randomized blocks. Individual plots contained two rows 50 feet long and 38 inches apart. The Rutgers variety of tomato was planted in one row of each plot and Summer Crook Neck squash in the other row.

Unfumigated control plots and plots given the standard row applications of DD mixture provided the basis for evaluation of six methods of applying DBCP. The two forms of DBCP used were: a granular formulation containing 17.3 per cent by weight of technical DBCP adsorbed in Attaclay granules, and an emulsible concentrate formulation containing 70.3 per cent technical DBCP by weight, Application of the emulsible concentrate was facilitated by diluting it with water 1:9. The dosage equivalent for solid, or overall, applications was 1.5 gallons per acre (150 pounds per acre of the 17.3 per cent granules, or three gallons per acre of the 70.3 per cent emulsible concentrate). For row applications, the dosage was 1.75 quarts per acre technical DBCP (43 pounds per acre of the granular preparation, or 3.5 quarts per acre of the emulsible concentrate). Dosages for the row treatments were calculated on the basis of the 38-inch row width.

Row treatments of DBCP were made with the following methods: emulsible concentrate solution was injected with constant gravity-flow equipment to a depth of eight or nine inches, the injection rows being listed on with disk hiller plows (figure 1.); DBCP-impregnated granules were distributed in the fertilizer row by means of a granular insecticide attachment (figure 2.); and a premixed blend of fertilizer and granular DBCP was distributed as a band placement under the planting row with standard fertilizer distributors (figure

Solid, or overall, treatments included: injection with constant gravity-flow equipment of emulsible concentrate solution on 12-inch centers to a depth of eight to ten inches (figure 3); the spreading of DBCP granules even-

(Continued on Page 95)

Effect of nematocide application methods on control of root knot on tomato and squash plants.

	Average root knot indicates ^a for six replications					
Application methods	Tomatoes :Squash June 10 : July 23 :July 23					
DBCP solid treatments	-					
Liquid, chisel	0.14	0.07	0.31			
Granular, applicator	0.03	0.05	0.32			
Granular, disk harrow	1.37	1.37	2.13			
DBCP row treatments	0.25	0.30	0.72			
Liquid, chisel	0.91	1,22	1.53			
Granular, applicator	1.05	1.45	1.49			
Granular, in fertilizer						
DD Mixture, row treatments						
Liquid, chisel	1.56	1.97	2.07			
Unfumigated controls	2.16	2.37	3.07			
L. S. D05	0.80	0.73	0.60			
L. S. D01	1.07		0.80			

*Based on scale from O, no galling, to 4, severe galling



SPECIALLY DESIGNED for the liquid fertilizers and farm chemicals you handle!



Again . . . in 1959 more farmers bought HAHN HI-BOY than all other makes combined!

Unequalled for liquid fertilizer application and for thorough spraying in cotton, corn, tabacco, sugar cane, small grains, vegetables and every other type of crop. The most comfortable and easiest to operate of all high-clearance units. Above: New Model H-300 with 30 h.p., 4-cylinder Wisconsin Engine; "live" pump drive; rust-proof aluminized-steel 8-row boom and 200 gal. tank; all-new frame with yoke rear wheels and with 7.50 x 20 tires; new full slope fenders (optional).

9 NEW MODELS . . . a size and price to match every need.

new HAHN TRAILER SPRAYERS

150 or 200 gal.

capacity Aluminized-

Steel Tank

and Boom!



Complete line of tractor mounted and trailer sprayers de-veloped specifically for applying liquid fertilizers and farm chemicals. New Model T-20 shown has 8-Row Ever-Level Boom that remains steady in roughest service.



Seal of Quality

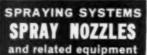


HAHN, INC. DEPT. AC-10 Evansville, Ind., Ph.: HA 4-0931

Send me the new 1960 Hahn Sprayers Buying Guide by return mail:

Name and Firm







for better, lower cost farm spraying



For the broadcast spraying of grains and grasses . grains and grasses . . . and distribution of nitrogen solu-tions and related liquid fer-

For complete information write for Catalog 30

SPRAYING SYSTEMS CO.

3230 Randolph St., Bellwood, Illinois



SPRAY NOZZLES

Precision built for uniform spray distribution and exact volume control. Over 400 interchangeable orifice tips for all spray patterns and chemicals.

RELATED EQUIPMENT FOR BOOM AND HAND SPRAYERS







PEST ROUNDUP

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is head—Survey & Detection Operations, Plant Pest Control Division. U. S. Department of Agriculture. His observations are based on latest reports from collaborators in U.S.D.A.'s pest surveys throughout the U.S.



Grasshopper Survey Counts Low

THE adult grasshopper survey conducted during the latter part of the summer of 1959 revealed infested acreage to be low. Although the counts made in the late summer are not positive criteria of the infestations that may be expected the following season, they do indicate a potential. Weather conditions, parasites and predators, and other factors are instrumental in determining the actual infestation that may develop.

Range areas in 13 western and midwestern states carrying at least a moderate number of adult grasshoppers, eight or more per square yard, total slightly more than five and one-half million acres. The largest acreage, almost 1,200, 000 acres, is in California, Montana is next with 1,000,000 acres, and Colorado third with 990,000 acres. Other states having more than 100,000 acres with moderate or above populations are: Texas with 873,000; New Mexico with 736,000; Wyoming with 380,000; and Idaho with 255,000 acres.

Adult grasshopper populations found on the croplands during the late 1959 survey were slightly below those of last year. States with the largest acreage carrying infestations which might produce damaging grasshopper populations in 1960 are: California, Colorado, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wisconsin.

Rice Disease Found in Wide Area

THE rice disease, hoja blanca, and/or its planthopper car-

rier, Sogata orizicola, has now been found in 14 Louisiana parishes; namely, St. Tammany, St. James, St. John the Baptist, St. Marys, St. Landry, La Fourche, Evangeline, Madison, Vermillion, Ascension, Assumption, Iberville, Terrebonne, and St. Martin. Forty-seven properties are involved. When the disease or vector is found, eradicative measuses are immediately initiated. Phosdrin was used in treating rice almost ready for harvest, otherwise the treatment consisted of a mixture of malathion and DDT.

No specimens of the carrier were found outside of Louisiana this season. The disease, however, was identified from rice planted on a nursery at Biloxi, Harrison County, Mississippi and from two blocks of volunteer rice on Rabbit Island in Palm Beach County, Florida. Extensive negative surveys were conducted in Arkansas, California and Texas.

Spread of Two Important Insects

THE alfalfa weevil, long known to be in the western states, but found in the eastern United States for the first time in Maryland in early 1952, is now known to be in Kentucky. Two adult weevils were taken July 7, 1959, in an alfalfa field 6 miles south of Horse Cave, Hart County. Further surveys failed to reveal additional specimens.

Following the initial find of the alfalfa weevil in Maryland, the insect has now been found in 16 eastern, central, and southern states ranging north to Massachusetts, south to Alabama, and west to Kentucky.

The European corn borer, which has gradually been spreading to the south and southwest primarily in recent years, was recently found in Texas. This first find was a single specimen from a field of late corn near Texarkana, Bowie County, Texas. Surveys in six northeastern counties in that area of Texas failed to reveal additional specimens.

Greenbug in Oklahoma and Texas

THOUGH populations have been light, the greenbug, by the latter part of November, had been found widely scattered in both Oklahoma and Texas. Light infestations of the insect were found in 11 of 18 Texas panhandle counties surveyed. The infestations were found only in large volunteer clumps around irrigation ditches, or where moisture had been abundant for some time. No greenbugs were found in drilled or small volunteer wheat.

By the latter part of November, greenbugs had been found in Jefferson, Marshall, Kingfisher, Bryan, Love, Payne and Washita Counties, Oklahoma. The heaviest count reported was six per linear foot or row.

A report dated November 13 stated that greenbugs were killing two-thirds of an oat field in Worcester County, Maryland,

Khapra Beetle Again in Calif.

A HE Khapra beetle was again found in California after 8 months of intensive inspection. At a Brawley, Imperial County,

(Continued on Page 96)

LISTENING POST

By Paul Miller



This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Mycology and Plant Disease Reporting Section, Plant Protection Research Branch, United States Department of Agriculture, Beltsville, Maryland.

Hexachlorobenzene for the Control of Onion Smut

RUBEN Duran and George W. Fisher*, of the Washington Agricultural Experiment Station, write that in recent years smut caused by the fungus Urocystis cepulae has become the most troublesome disease of onions in the Walla Walla district of eastern Washington.

Between seasons, the fungus lives by means of spores in the soil. Onion plants can be infected only during a very young seedling stage, older seedlings being immune. Formerly, growers in the Walla Walla district controlled smut by growing the seedlings in contaminated soil until the plants had passed the susceptible stage, and then transplanting them to the field. The soil is now entirely contaminated with the smut fungus, however: therefore as no more smut-free soil is available for growing seedlings this method of control can no longer be used. Smut infection of seedlings, which often amounts to as much as 50 to 75 per cent, causes loss in several different ways. Infected seedlings, which would not produce saleable onions even if they survived, must be detected and removed to prevent their transplantation to the field; as a result, not enough seedlings are left to fill the needs of the growers; finally, heavy planting to replace seedling losses adds to the costs.

Formaldehyde soil treatment is effective, but the growers con-

sider it a nuisance to use. Thiram has given good results in other localities but has not been satisfactory in the Walla Walla area. Thus, since the usual methods have been rejected or are ineffective it has become necessary to find some other safe, practical and easily used means for controlling smut.

Duran and Fisher report results of trials made during 1957 and 1958. Their account emphasizes observations on hexachlorobenzene (HCB) and discusses other materials only briefly, so results with materials other than hexachlorobenzene are omitted here.

Field Experiments: In the

preliminary experiments in June 1957 a number of fungicides were included, but a proprietary compound containing 40 per cent HCB was tested most extensively, as this material had just been determined to be highly effective for controlling another disease, wheat flag smut, caused by a species of Urocystis.

Subsequent field experiments were started in late summer, the normal time for planting onions in the area. The onion maggot had been so destructive in the preliminary trials, that insecticides as well as fungicides were included in the later tests.

All field trials were made in naturally infested soil. In all experiments seed was planted in 6or 7-foot rows, randomized and replicated. In the preliminary trials the seed was pelleted with equal part by weight of the fungi-

(Continued on Page 67)

Table I. Results of greenhouse experiments comparing effects of different proprietary preparations of hexachlorobenzene used as seed treatments for controlling onion smut, as shown by seedling stand, percent of smut, and weight of seedlings.

Treatment	Number of seedlings	Percent smut	Size: Average weight per seedling (grims)
Brand I 80h	311	8.6	.0964
Brand A 80	221	9.9	.0737
Brand I 40	257	45.9	.1073
Brand B 40	244	47.9	.1040
"Homade"e 20	310	58.06	.1509
Brand C 40	179	63.1	.1055
Brand D 40	81	35.8	.0691
Brand E 40	42	9.5	.0523
Brand F 80	23	17.3	.0739
Brand G 40	37	18.9	.0405
Check (sticker only)	206	93.2	.0854

aAverage of two replications of two 44-inch rows using need pelleted with HCB at at 1:1 ratio by weight and a 4-per cent methyl cellulose sticker bThe number indicates the percent of active ingredient, cA laboratory formulation.

Arcadian News

Volume 5

For Manufacturers of Mixed Fertilizers

Number 1

FERTILIZER SURVEY SHOWS OPTIMISM FOR 1960 SALES

Industry Leaders Are Enthusiastic

Forecasts by leading fertilizer men around the country indicate a good fertilizer year ahead. Many factors contribute to the general feeling of optimism that 1960 will be a promising year for sales of mixed fertilizers, according to a recent national survey conducted by Nitrogen Division.

The survey, designed to report industry leaders' opinions and help determine the market potential for this year, produced a host of comments which clearly point out that the swing toward increased use of fertilizer continues. Farmers are bringing more and more acreage under fertilization, and at the same time are stepping up application rates. The trend toward use of higher analysis mixed goods also is on the upgrade, fertilizer leaders note.

Progressive, management-minded farmers are finding that good mixed fertilizers with high nitrogen content are indispensable to profitable production of so many crops. This agri-business concept has helped create an awareness value of intelligent fertilization. It also is receiving widespread support from federal and state agricultural leaders who encourage the use of more fertilizers for better crop growth.

A chief factor which points toward

increased use of fertilizer is the low soil fertility now existing in most farm areas. High yields in 1959 depleted soil fertility, so even though acreages of major crops this year will probably be about the same as last year, it is likely that more fertilizer will be applied.

In 1959, crops were planted on large acreages that formerly were in the soil bank. Soil fertility had been built up. This will not be true this spring, fertilizer experts explain. They emphasize that the plant food removed by harvests will have to be replaced just to maintain yields.

With the outlook for lower prices for many farm products this year, farmers will want to increase crop production to improve income. A large majority of growers will be counting on fertilizer as their best bargain to get this desired production.

Most fertilizer leaders agree, the survey indicated, that 1960 could be a banner sales year—barring unusual weather conditions which might reduce the large fertilizer applications that are expected.

Northeast has High Hopes

"The picture is really bright in the New England states." This was the commentary of a key fertilizer man who went on to say: "Potatoes are marketing at exceptionally high prices, which will lead to increased fertilizer application next season. We might have more potato acreage, as well. Dairy farmers are as solid as ever, and should buy fertilizer again this year. Small grains are off, so there will probably be less movement there."

Fertilizer people in Pennsylvania have been concentrating on raising plant food rates for the past two years. They believe their efforts will pay off with bigger fertilizer usage in plow-down on corn land this spring. A sample opinion from the southwest part of the state indicated that fertilizer application might go 10% higher than last year.

Throughout Pennsylvania and New York, dairymen will be better customers for fertilizer than ever before, according to most fertilizer manufacturers. However, cash crop vegetable farmers in these states probably will buy a little less than in 1959. The New Jersey prospect is only fair, industry leaders predict, due to a poor crop year. Long Island potato fertilizer demand should go unchanged, and small package fertilizers look promising in that area.

Generally, higher nitrogen ratios are gaining wider acceptance in the Northeast. There has been a surprisingly heavy demand for new 15-10-10, it was pointed out. This fertilizer chalked up unprece-

(Continued on following page)

(Continued from preceding page)

dented sales during its introductory year. Use of 1-1-1 still is increasing, and sales of 2-1-1 also are climbing.

Midwestern Demand Excellent

This fast-growing fertilizer market continues to expand. An lowa fertilizer manufacturer forecasts that his state can look forward to "the biggest spring movement ever, because of excellent yields last year and low fall application." He also cites good moisture conditions in the soil as a favorable factor.

Similar opinions are expressed in Nebraska and Kansas. The industry there believes it will enjoy a large spring demand for mixed fertilizers because of 1959's outstanding yields. Agronomists report there is excellent sub-soil moisture—the best since the fall of 1951. Fertilizer men say there is another noteworthy fact which will have a bearing on sales this spring: wheat farmers in these states are swinging over to higher nitrogen mixed goods at planting time.

A heavy sales season is predicted for Minnesota and Wisconsin. "One big reason," a fertilizer industry spokesman says, "is the extremely poor fertilizer season we had last fall. Early frost and snows prevented field work after harvest."

Both Missouri and Illinois had slow fall movement—the result of heavy fall rains and early cold weather that shortened the wheat planting and fall plowdown seasons. Here again, spring sales are expected to be heavy, industry leaders believe.

An Indiana fertilizer manufacturer says sales in his state should be "every bit as good as last spring, but movement will be late, starting in March." The prospect is even better in Michigan. "We have a combination of a fine crop year—particularly in corn, beets and beans—and low fall deliveries will mean heavy movement this spring," a Michigan fertilizer man states. Movement in Ohio will be greater than last year, and early, if weather permits.

Great Fertilizer Response

A number of favorable signs combine to point toward a big fertilizer year in the Midwest, but perhaps one of the most significant is the great response which corn growers have obtained from fertilizers. Performance is really building a fertilizer market in the corn country, according to Midwestern fertilizer people.

Throughout this rich agricultural area, farmers continue to increase both the application rate and nitrogen content of mixed fertilizers. In Indiana, for example, good success last year will get the 2-1-1 ratio off to a flying start for plowdown, starter and side-dress. Higher analysis and a higher percentage of nitrogen in mixed fertilizers are more popular in Ohio, Illinois and Iowa, manufacturers explain.

The high acreage of the Midwest's total land which will be going into corn creates a large demand for fertilizer. One sales representative sums it up this way: "We think there are plenty of good reasons for all this optimism."

Southern Predictions

Southern predictions indicate the average of fertilizer sales for the area will rise above last year's level. Here, as in other areas with large-scale demonstration programs that show benefits of heavy fertilizer use, the increased crop yields which result from these demonstrations help promote greater fertilizer demand.

"Intensified Soil Fertility Programs" sponsored by group effort in several Southeastern states are accomplishing outstanding results. Every farm in a county is soil tested and every farmer is encouraged to fertilize at least one crop according to its needs.

In North Carolina, a fertilizer leader expects sales to go up by about 5%. However, Virginia will probably drop below last year's total. Opinions from Maryland, Alabama and Florida indicate these states can be expected to match their 1959 performances. A Georgia supplier

Now is the time to buy

NIXED FERTILIZERS

and Arcadian

Ammonsum NITRATE

- an ideal combination for big yields!

One will be a second or a second or

Here is one of the many Nitrogen Division full-page farm magazine advertisements, promoting the use of mixed fertilizers. of mixed goods thinks his market may be off a little because of a poor crop year.

The consensus from Kentucky and Tennessee, however, is that manufacturers will enjoy a 10 to 15% bigger demand for fertilizer over last year. While not seeing so high a rise, experts in the Delta think more fertilizer definitely will be bought this year.

Sales of mixed goods in South Carolina are expected to be similar to last year in total tonnage, with some possibility of earlier movement. Intensified Soil Fertility Programs are making progress in this state, and in Georgia, North Carolina and Alabama. As these programs spread across the country, they are bound to increase tonnage and encourage use of the right analyses.

One Eastern seaboard manufacturer notes a highly-significant trend toward sales of granular and semi-granular mixed goods. Maryland is seeing wider use of high analysis grades like 15-10-10.

Prospects for the West

Comments from the West indicate an expected 10 to 15% increase in tonnage this spring for the Rocky Mountain area. Some of the largest crops of sugar beets, corn and small grains ever harvested were registered there in 1959. Growers are being urged by sugar companies and state agricultural colleges to fertilize more heavily in 1960.

Western fertilizer men believe rates of application will continue to increase about 15 to 20% over last year. They think the future will see more and more fertilizer applied before planting.

In West Texas and New Mexico, industry people say the general outlook is excellent. Bumper crops vere produced last year, and farmers generally have funds available for fertilizer. "Last year," one agricultural expert states, "farmers who used generous amounts of fertilizer reaped a large return, and this should lead to even greater sales this year. We also expect an increase in cotton acreage in this area." He goes on to say that more pre-plant fertilization and less side-dressing are predicted for the coming season.

Spring Outlook Optimistic

Nitrogen Division's comprehensive survey of opinions and predictions across the country adds up to this: There's a good spring season ahead!

While there are a few areas where some pessimism is voiced, the fertilizer industry as a whole is booming with optimism. It looks like another good year for sales of mixed fertilizers.



YOU NEED MORE THAN SOIL TESTS TO DETERMINE PLANT FOOD NEEDS

How much plant food should the farmer apply to his fields? Most farmers and fertilizer dealers are under the impression that a soil test answers this question. It does no such thing! A soil test tells only the amount of plant food that is available in the soil. To determine how much fertilizer to apply we also need to know: How big a crop does the farmer wish to grow? If no yield goal is set, then recommendations based on soil tests are usually made for an average yield. Sometimes, results of fertilizer use are disappointing for this reason alone.

It is important to remember that plants are not able to take from the soil all of the plant food which shows up in the soil test. Roots do not touch all soil particles. Corn roots, for example, touch only 5 to 10% of the soil particles in the root zone. Plant foods such as nitrogen, phosphorus, potash and calcium do not mix in soils like sugar in coffee.

Soil scientists have determined that 50% to 75% of the nitrogen applied is picked up by the first crop of corn. Nitrogen is the most available of the three major plant foods. Phosphorus usually is the least available, and under average conditions, in the year after application, crops may take 20% to 40% of applied phosphorus out of the soil. In some cases, no more than

15% of the material is taken up because of such factors as low pH, improper application or poor weather. Potash applied in fertilizer is more mobile than phosphorus, and is about 50% to 60% efficient in its uptake by the corn plant.

Thus a good plant food prescription plan takes into account the following:

Availability of plant food in the soil.
 Efficiency of fertilizer to be applied.
 Yield of crop to be produced.

The fertilizer dealer who succeeds builds a reputation for dependability. The prescription plan wins satisfied customers who stay sold on good fertilizer service. These customers produce greater and steadier profits for the fertilizer dealer. Fertilizer dealers, agricultural advisors or farmers-whoever determines how much fertilizer should be applied to a given field-have a solid basis for developing a realistic plant food prescription. Farmers today are willing to spend more time determining the amount of plant food they should use. Gone are the days when growers put on 100 pounds of 2-12-6 to the acre for any crop with the idea that this would surely do the job.

At that time, few persons realized that with 60% efficiency, the 2 pounds or 32 ounces of nitrogen in this combination were really only giving them 20 ounces

of this valuable plant food per acre. And even fewer realized that this 20 ounces of nitrogen was only enough to produce an increased yield of 1 bushel of corn.

Farmers used to plant 16,000 corn plants per acre. By dividing 20 ounces of nitrogen into 16,000 parts, one can see even more dramatically the minute amount of nitrogen that was given to each corn plant. Agriculture has come a long way from the time when 100 pounds of 2-12-6 were popular. Now we find progressive growers applying 150 to 200 pounds of actual nitrogen per acre.

Here is a typical example of how a plant food prescription for a 100-bushel corn crop would be calculated. Suppose a test shows the soil contains 250 pounds of nitrogen, 75 pounds of P₂O₅ and 180 pounds of K.O per acre. The amount of food available to plants actually would be 100 pounds of nitrogen, 30 pounds of P₂O₅ and 72 pounds of K.O. The farmer would be short about 60 pounds of actual nitrogen, and it can be figured quickly that he would need to add about 100 pounds of nitrogen, 60% of which would give him the 60 pounds required.

Actual P₂O₅ would be short about 30 pounds, and he would have to add about 100 pounds to make up for the inefficiency of this ingredient. The correct amount of K₂O is a little easier to calculate because it is 50% efficient, so the farmer knows he is short about 50 pounds. He would need to add 100 pounds in order to meet the requirement.

With the addition of the above amounts of each plant food, the farmer now has the requirements of 160 pounds of nitrogen, 60 pounds of P_2O_5 and 125 pounds of K_2O that will enable him to grow a 100-bushel corn crop.

Since any one year's crop can remove only part of the fertilizer elements in the soil, a considerable amount remains in the ground to feed succeeding crops. Even though a farmer keeps accurate records of fertilizer applications and crop yields on each field, rainfall, soil type, crop rotation and other factors can vary this carryover of fertility in the soil. Accordingly, a soil test every few years helps the farmer keep track of this soil fertility buildup, so that his prescriptions for adding fertilizer will be more accurate. A soil test every year, of course, would give a more exact basis for fertilizer prescriptions.

More than 45 factors affect the yield of a crop, and nitrogen, phosphorus and potash are not the only things for the farmer to consider. But when he does apply the necessary plant food, he is far more likely to get the yield he desires. Good yields usually are planned. As a rule, they just don't happen. Urge your fertilizer dealers to adopt the plant food prescription method when they make fertilizer recommendations. For everyone who has tried it, this realistic sales technique has paid big profits!

HERE'S THE BIG LINE OF

When you purchase your nitrogen requirements from Nitrogen Division, Allied Chemical, you have many different nitrogen solutions from which to select those best suited to your ammoniation methods and equipment. You are served by America's leading producer of the most complete line of nitrogen products on the market. You get formulation assistance and technical help on manufacturing problems from the Nitrogen Division technical service staff. You benefit from millions of tons of nitrogen experience and the enterprising research that originated and developed nitrogen solutions.

Arcadian

NITROGEN SOLUTIONS

	CHEMICAL COMPOSITION %						PHYSICAL PROPERTIES		
\	Total Nitrogen	Amhydrous Ammonia	Ammonium Nitrate	Urea	Water	Neutralizing Ammonia Per Unit of Total N (lbs.)	Approx. Sp. Grav. at 60° F	Approx. Vap. Press. at 104°F per Sq. in. Gauge	Approx. Temp. at Which Salt Begins to Crystallize °F
NITRANA"	1	1000	1		1000	REAL PROPERTY.	ALC: S		
2	41.0	22.2	65.0	-	12.8	10.8	1.137	10	21
2M	44.0	23.8	69.8	-	6.4	10.8	1.147	18	15
3	41.0	26.3	55.5	-	18.2	12.8	1.079	17	-25
3M	44.0	28.0	60.0	-	12.0	12.7	1.083	25	-36
змс	47.0	29.7	64.5	-	5.8	12.6	1.089	34	-30
4	37.0	16.6	66.8	-	16.6	8.9	1.184	1	56
4M	41.0	19.0	72.5	-	8.5	9.2	1.194	7	61
6	49.0	34.0	60.0	-	6.0	13.9	1.050	48	-52
7	45.0	25.3	69.2	-	5.5	11.2	1.134	22	1
URANA"					13 18 19	625 (I)	12505		300
6C	43.0	20.0	68.0	6.0	6.0	9.3	1.180	12	39
6M	44.0	22.0	66.0	6.0	6.0	10.0	1.158	17	14
10	44.4	24.5	56.0	10.0	9.5	11.0	1.114	22	-15
11	41.0	19.0	58.0	11.0	12.0	9.2	1.162	10	7
12	44.4	26.0	50.0	12.0	12.0	11.7	1.087	25	- 7
13	49.0	33.0	45.1	13.0	8.9	13.5	1.033	51	-17
15	44.0	28.0	40.0	15.0	17.0	12.7	1.052	29	1
U-A-5"	The same	PSE ST	PIEST	STEEL ST	Blick.	The said		60 BES	Sec. 13-
A	45.4	36.8	-	32.5	30.7	16.2	0.932	57	16
В	45.3	30.6	-	43.1	26.3	13.5	0.978	48	46
Anhydrous Amusonia	82.2	99.9	-	-	-	24.3	0.618	211	-108

Other ARCADIAN® Products: URAN® and FERAN® Solutions • Ammonia Liquor • N-dure® A-N-L® • Ammonium Nitrate • UREA 45 • Nitrate of Soda • Sulphate of Ammonia

NITROGEN DIVISION

MAIN OFFICE: 40 RECTOR ST., NEW YORK 6, N. Y., PHONE HANOVER 2-7300



 Hopewell, Va., P. O. Drawer 131
 Glenview 8-6301

 fronton, Ohlo, P. O. Box 98
 Drexel 7-4366

 Omaha 7, Neb., P. O. Box 166
 Bellevue 1464

 Raleigh, N. C., 606 Capital Club Bidg.
 Temple 3-2801

Columbia 1, S. C., 1203 Gervais St. Alpine 3-6676 Atlanta 3, Ga., 127 Peachtree St., N. E. Jackson 2-7805 Memphis 9, Tenn., 1929-B South 3rd St. Whitehall 8-2692 Columbia, Mo., 1134 Highway 40W Gibson 2-40-40 Indianapolis 20. Ind., 6060 College Ave. Clifford 5-5443 Kalamazoo, Mich., P. O. Box 869 Kalamazoo 5-8676 St. Paul 14, Minn., 764 Vandalia St. Midway 5-9141 San Francisco 4, Cal., 235 Montgomery St. Yukon 2-6840

cide, and a 4-percent methyl cellulose sticker. Pelleting was the method chiefly used in later trials also, but in some of the treatments the fungicide was applied in the furrow at the time of planting. Insecticides were dusted in the furrow after the fungicide-treated seeds were planted.

About 2 months after planting the seedlings were carefully dug and the roots washed; the seedlings were kept in a refrigerator in moist paper towels or paper bags to prevent their drying out. The percentage of increase or decrease in the amount of smut as compared with that in untreated checks was the basis for determining the relative efficiency of the different treatments.

The preliminary (June 1957) experiments were so badly damaged by onion maggot that results were not formally recorded. However, enough seed treated with HCB had been planted to give highly encouraging indications of the usefulness of this material. Less than 1 percent smut occurred in two rows about 100 feet long of seedlings from treated seed, compared with considerable smut in the check plots. (Exact percentages could not be determined because of maggot damage).

In 1958 seed was planted September 3 and 4. Because of the promising results obtained in 1957. 40-percent HCB, of the same commercial brand but from a different lot, was again most thoroughly tested. In 1958, however, the HCB treatments showed unexpected evidence of phytotoxicity, pronounced in some cases. This was a great disappointment in view of the satisfactory control and good stands obtained in 1957. Seed treated with HCB had failed to germinate or had begun to germinate only very slowly as late as 4 weeks after planting, whereas in other treatment plots, including the checks, seedling stands were excellent. Pelleting, which allowed the fungicide to remain on the seed during germination, resulted in greatest injury.

Control was only fair as compared with that obtained in 1957. The 1958 trials were on a different plot, much more highly contaminated with smut, as shown by the amount of the disease in the checks during the two years (92 percent in 1958; 36.4 percent in 1957).

Greenhouse Experiments: In experiments set up to explain the discrepancies between the 2 years' results, the authors used nine different commercial preparations of HCB, three containing 80 percent and six 40 percent of active ingredient, and one laboratory formulation of 20 percent technical HCB with a frianite diluent. Seed was pelleted with equal parts by weight of fungicide and a 4- percent methyl cellulose sticker. The check seed was pelleted with the sticker only. The experiment involved 11 treatments in 44-foot rows replicated twice in two randomized blocks.

Results, summarized in Table 1, indicate considerable differences, both as to control and phytotoxicity, among the different formulations.

During the smut counts for the 1958 field and greenhouse trials it was noticed that the most phytotoxic brands of HCB produced stubby seedlings which often remained permanently stunted. This effect was reproduced in a laboratory test in which onion seed pelleted with one of the highly toxic 40-percent formulations was germinated between moist paper towels at room temperatures, with a similar sample pelleted only with the sticker as the check. Percent germination was, after 5 days: treated seed 33.3, untreated seed 80; after 10 days: treated seed 48, untreated 100. After 14 days the treated seed gave 95 percent germination. The seedlings were measured after 20 days; the seedlings from treated seed were thick and short, 2.5 to 3 millimeters in diameter by 20 millimeters long, whereas those from untreated seed were thinner and longer, 0.5 to 1 by 45 to 50 millimeters.

The safety and efficacy of "Brand I 80," which was outstanding in the tests summarized in Table 1, were tested again in another experiment. As before, pelleted seed was used for both fungicide and check treatments. Results were as follows: total number of seedlings, from treated seed 3971, from untreated seed 3640; total number of smutty seedlings, from treated seed 35, from untreated seed 2264; total weight of healthy seedlings, from treated seed 287.8 grams, from untreated seed 108.8 grams; average weight of healthy seedlings, from treated seed 0.0731 grams, from untreated seed 0.0790 grams; percent smut, from treated seed 0.88, from untreated seed. 62.19

The authors conclude that HCB is a very promising material for the control of onion smut, especially in locations where other fungicides have not been satisfactory. However, their results showed serious and striking differences among the various proprietary HCB formulations tested. A few brands were both non-phytotoxic and very effective for control; others were not very effective and were highly phytotoxic. These discrepancies were not explained by the percentage of active ingredient. Possibly they were due to chemical variation; perhaps the diluent or differences in the technical grade of HCB were responsible. Some technical grades of HCB might contain phytotoxic impurities.

They conclude further that, so far as their trials indicated, only one proprietary formulation ("Brand I 80" of Table 1) could at present be recommended for use in controlling onion smut, and this only with the proviso that the manufacturer did not alter its ingredients from those of the preparation as used in their tests. They give this warning because the very different resuts obtained from a single brand from one year to the next indicated some modification in ingredients between the two years. **

WANT ACTION ON YOUR CLAY ORDER?



MAGNET COVE BARIUM CORPORATION

Philadelphia 7, Pa. 702 Western Savings Fund Bidg. Houston, Texas P. O. Box 6504



Fertilizer Views and News

Production Equipment Prominent at Chemical Show

SOME 550 exhibits were displayed at the 1959 Exposition of Chemical Industries, held early in December at the Coliseum in New York City. Equipment manufacturers were in the majority, with most of the equipment much the same as exhibited in previous shows. However, in many cases, improved performance was claimed for the new models, because of variations in engineering, construction materials, etc.

Chemical construction firms were well represented, as well as the laboratory equipment suppliers and instrument makers. Raw material suppliers were down in attendance, confirming a trend apparent for several years at the show.

Equipment makers are not optimistic for 1960, attributing some of this attitude to the steel strike, and curtailment of long range expansion plans by the chemical industry in general. Bucking this outlook for the chemical industry, however, is a very promising prospect for further expansion by the fertilizer industry. Foreign construction, too, is expected to increase.

Because of interest in dust and fume control equipment for the fertilizer industry, displays attracting attention of fertilizer manufacturers included Chemical Construction Corp.'s Pease-Anthoni venturi scrubber; the Jet-O-Clone dust collector (cyclone type) offered by Fluid Energy Processing and Equipment Co.; National Dust Collector's wet - type scrubber; Pangborn Corp.'s bag-type dust collectors; a wet scrubber offered by Dustex Corp.; and dust filtering equipment by Day Company.

Among the mill and pulverizer displays of interest to fertilizer manufacturers were those by: Combustion Engineering, Inc., Hardinge, Inc.; Sturtevant Mill Co.; Williams Patent Crusher & Pulverizer Co.; and Kennedy Van Saun Mfg. & Engineering Corp.

Fine pulverizing and grinding, such as required in the insecticide industry, was featured in several displays, including: Combustion Engineering's vertical mill; Sturtevant's new pulver-mill (for DDT grinding and formulating), and its 'Micronizer', a fluid energy mill; Fluid Energy Processing's fluid energy pesticide mill; and a new mill for pesticide grinding designed and made in England, and displayed by Southwestern Engineering Co.

Showing chemical materials and supplies of interest to agricultural chemical manufacturers were displays by Johns Manville Co.; Eagle Picher Co.; Metalsalts Corp; Monsanto Chemical Co. and West Virginia Pulp & Paper Co. Continental Can Co. displayed several drums, featuring new closures. Bags were displayed by Bemis Bag Co. and Union Bag-Camp Paper Corp. Mine Safety Appliances Co, exhibited new designs in its line of masks, which permit workmen to put the masks on over regular eveglasses.

At the exhibit of Edw. Renneburg & Sons. Co., dryers, coolers, mixers, etc. for the fertilizer industry were featured; while Young Machinery Co. displayed its mixers and conveyors. **

Grass Productivity, by André Voisin, Philosophical Library Inc., New York, N. Y., 353 pages, 1959. Reviewed by Vincent Sauchelli.

This is one of those rare books in which the author combines science and a wealth of personal, practical experience, and the result makes a valuable addition to our knowledge. Agriculture has made wonderful advances in the culture of field and vegetable crops. In many countries of Europe and the Americas, grassland farming lags far behind in the progress towards high efficiency and net profit.

The author has learned through experience and broad studies that there is a significant difference between grassland management and grazing management. When he applied the principles of what he calls "rational management" to his own grass areas, he trebled the yields and the starch equivalent production of his grassland, exceeding that of any arable crop grown under similar conditions.

Mr. Voisin does not believe it is generally wise to plow long-standing pasture merely to re-establish it, as is being recommended in Great Britain and by specialists in our own country. A great deal can be done with established pastures to increase productivity by proper grazing and surface treatment.

Meet Ray Funk



Ray Funk is one of the men who have helped build Standard Oil's reputation for delivering NH₃ and Nitrogen Solutions on time and when promised. Working through Standard's traffic department shipments are expedited and followed closely to assure delivery. Ray's knowledge of such things as when the tank car will leave the area and the number of lines handling are what assure you that the car you've ordered will be coming onto your siding when it is due.

Ray keeps a running record of tank cars available, and he knows accurately the schedule of truck shipments. He is thus able to help customers estimate the delivery time on NH₃ and Nitrogen Solutions shipped by truck.

You don't learn this job overnight. Certainly Ray didn't. He's been in the Standard Oil sales department for 22 years. Thirteen of these years have been in customer service work. Many's the time Ray has been on the telephone at home after midnight making sure someone's shipment went through on time.

Is this the attention you would like your purchases of Anhydrous Ammonia and Nitrogen Solutions to receive? Well, it's the kind of care your order gets at Standard. Get all of the facts from your Standard Oil representative. Or write, Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, III.

You expect more from



and you get it!

NEWS about the TRADE

Hall Heads Potash Co.

John W. Hall was elected president of the Potash Co. of America, Carlsbad, N. Mex., at a special meeting of directors of the company in Denver last month.

Mr. Hall was elected following the resignation and retirement of F. O. Davis. With Potash Co. for the past ten years, Mr. Hall has been vice president in charge of sales for four years. Prior to joining Potash Co., he was with Swift & Co. for 17 years in sales, purchasing, and as plant manager.

Mr. Davis has been with Potash Co. since 1936 and has been president since the retirement of G. F. Coope in 1958. He has agreed to remain available to the company on a consultative basis.

Midwest Fertilizer Meeting

The 12th annual Joint Meeting of Midwestern Agronomists and Fertilizer Industry Representatives will be held at the Edgewater Beach Hotel in Chicago, February 11-12

Among features of the meeting will be a report on "What Farmers Expect from Their Fertilizer Dealer", by Dr. Joseph Bohlen and George Beal, Iowa State University rural sociologists. Soils specialists, from four midwestern agricultural colleges also will present reports on fertilizer use.

Record Sulfur Consumption

Consumption of sulfur in the United States recovered from a twoyear decline in 1959 to reach a new record high, according to preliminary estimates reported by the Freeport Sulphur Co., New York. An increase of better than ten per cent over 1958 was reached last year with a total consumption of 6,000,000 long tons. The previous record year was 1956, with 5,800,000 tons.

Alabama Pesticide Conference

The need for pesticides in modern America will be the theme of the Feb. 17-18 annual Pest Control Conference and meeting of the Alabama Association for the Control of Economic Pests on the Auburn University campus, Auburn, Ala.

Polite Joins Dixon

L. John Polite Jr., has been appointed to a senior executive capacity by Dixon Chemical & Research, Inc., Bloomfield, N. J. He had been sales manager for the chlorinated products division of the Diamond Alkali Co., Cleveland.

Southern Weed Conference

Various phases of research and education pertaining to chemical weed control will be discussed by some of the nation's top authorities during the 13th annual Southern Weed Conference, Jan. 20-22 at the Buena Vista Hotel, Biloxi, Miss.

Related subjects have been grouped together and will be discussed in sectional sessions. Topics include: control of woody plants; weed control in crops; extension aspects of weed control; fundamental research and herbicidal activity; weed control in horticultural crops; and control of special weeds.

President Of Dorr-Oliver

L. R. Boling, former executive president, has been elected president of Dorr-Oliver, Inc.



Mr. Boling joined the company in 1941, following eight years with the California Spray Chemical Corp.

On Jan. 1 of last year, he was named vice president for operations coodination and, on June 15, was elected executive vice president and chief executive officer.

Liquid Fertilizer Conf.

A Southern Regional Liquid Fertilizer Conference will be held at the Rock Eagle 4-H Club Center, Feb. 9-11.

Sponsored jointly by the seven land-grant colleges in the Tennessee Valley states and the Tennessee Valley Authority, the conference will cover the comparative agronomic value of liquid fertilizer, methods of application of liquid fertilizer, and economic considerations of the use of liquid fertilizer. Also on the program are talks about corrosion problems and the establishment and operation of liquid fertilizer plants.

Thomas H. Lathe Retires

Thomas H. Lathe has retired after 32 years with Wilson & Geo. Meyer & Co., San Francisco. For most of that time he had been in charge of agricultural sales in the Pacific southwest.

Joins Bemis Packaging Service

T. I. B. Gray has joined the Packaging Service Department of the Bemis Bro. Bag. Co. in Minneapolis.



3 MEN DO WORK OF 4, and cut material handling costs 15%

in switch to Michigan Tractor Shovels

By equipping standard 16 cu ft Tractor Shovels with ¼ yd buckets, Growers Fertilizer Co-operative, Lake Alfred, Florida, has cut handling costs 15 per cent.

Growers' problem had been a common one . . . how to put greater efficiency into a system where weighing, mixing, and truck loading all were completely automatic. Only in such Tractor Shovel operations as unloading box cars, storing material, and feeding hoppers could there be much improvement.

With this limitation, plant manager Ed Shores' first thought was to get bigger machines. It was about time to trade in his four old 15 cu ft Tractor Shovels anyhow. But an increase of even one size range would keep the Tractor Shovels from readily passing through aisles, box car doors, and among some of the 38 bins (which ranged from 40 to 500 tons in capacity).

Then, a different make of Tractor Shovel came to mind. This machine—a 16 cubic ft power shift-torque converter Michigan Model 12B—would help boost production simply by preventing the end-of-shift fatigue that comes from constant clutching and declutching. Too, its extra cubic foot of capacity could up production—though only another 100 lbs or so per load.

That's when the key idea was born. Fertilizer is, after all, a relatively light material—the heaviest Growers Co-op handles weighs 110 lbs per cu ft. Perhaps the Michigan Model 12B could swing a bigger bucket, thought Mr. Shores. How about the standard Clarkbuilt ¼ yarder? Fully heaped, it would carry 2230 lbs—470 lbs (27%) more than could the 16 ft bucket. Yet, it's load would be well under rig's lift-and-carry capacity of 3,000 lbs. And its extra width, 4 inches, would cause no maneuverability problems.

A three-day on-the-job trial resulted. Michigan and the ¼ yd bucket performed "with highest honors." Loads weighed out at 2200 lbs or better. Each 40 ton box car was unloaded in about 1½ hours. Feeding the hopper from a stockpile 40 feet away, the 12B delivered 77 tons of fertilizer per 50-minute hour.

With the fatigue factor reduced, operator made more runs in a day.

Result . . . the Co-op ordered three new Michigans to replace the four old machines.

Today, the combination of eliminating one Tractor Shovel and getting more production from each machine has provided the company with an over-all cost saving of 15 per cent! Yearly output, with only 12 men, is up to 100,000 tons, 700 grades of fertilizer, per season.

Perhaps the Model 12B Michigan can give you similar economies. Test one in your plant for proof—using the size bucket, 6 to 27 cubic ft, which best fits your material, job conditions, and production needs. Write us to arrange the details.

Michigan is a registered trademark of

CLARK EQUIPMENT COMPANY
Construction Machinery Division



2463 Pipestone Road Benton Harbor 10, Michigan In Canada: Canadian Clark, Ltd.

Geiger Award To Onstat



Perry O. Onstot (right), agronomist and mixed fertilizer sales promotion manager, W. R. Grace & Co., Davison Chemical Division, Baltimore, has been named as the 1959 recipient of the Marlin G. Geiger award, given annually to a Davison employee who has made outstanding contributions to the progress of the company. Mr. Onstot was chosen for his development of the Davco Crop Feeding Program.

Marlin G. Geiger (left), executive vice president of Grace in charge of chemical divisions, made the presenta-

tion to Mr. Onstat.

California Weed Conference

The 12th annual California Weed Conference will be held Jan. 19 to 21 at the Sacramento Memorial Auditorium in Sacramento, Discussions will cover new developments in herbicides, weeds in forest plantings, field observations with wetting agents, and secondary weed invasions.

In addition, a panel discussion of regulatory considerations in weed control is planned and representatives of the Bureau of Chemistry, California Department of Agriculture, and the U. S. Food and Drug Administration will discuss registration requirements for herbicides.

Amend Screwworm Regulations

Shipping restrictions on movement of farm animals from Florida into other states, imposed because of the screwworm, have been lifted by the U. S. Department of Agriculture as a result of progress in the Southeast in eradicating the pest.

Israeli Production Up

Fertilizer output in nearly all plants of Fertilizers and Chemicals Ltd., Haifa, Israel, last year, exceeded the figures of the previous year by ten to 50 per cent. In addition, the company reports that erection of its new plants is ahead of schedule, so that, by next summer, Israeli farmers will be able to buy their fertilizers in either granulated or liquid form.

Georgia Plant Food Meeting

The annual meeting of the Georgia Plant Food Educational Society will be held Jan. 14 and 15 at the Georgia Center for Continuing Education in Athens, Ga.

A panel discussion will cover "Our Farmer Customers—Today and Tomorrow". It will be moderated by W. W. Harley, Southern Fertilizer & Chemical Co., Savannah

NE Fertilizer Workshop

The Northeast Fertilizer Promotion Workshop will be held Jan. 21 at the Hotel Hershey, Hershey, Pa. Among the features of the meeting will be an Empire Sales film strip presentation on "Four Steps to Profitable Plant Food Sales" and discussions of selling tools and customer's needs.

The workshop is sponsored by the National Plant Food Institute and all member companies doing business in the northeast have been invited to send salesmen and dealers to the workshop. Representatives of fertilizer manufacturers which are not members of NPFI will not be permitted to attend. Dr. Russell Coleman is chairman.

Weed Control Conference is Held January 6 to 8 in New York

THE 14th annual meeting of the Northeastern Weed Control Conference was held Jan. 6, 7, and 8 in the Hotel New Yorker, New York. In addition to general sessions, sectional meetings were planned to cover weed control as it pertains to: horticultural crops; agronomic crops; industrial and highway areas; public health; and aquatics, conservation, and forestry.

Among the topics on the program were: granular herbicides and new developments in application equipment, discussed by L. L. Danielson, USDA, Beltsville, Md.; and promising new chemicals for weed control, by M. W. Meadows, G. L. F., Ithaca, N. Y.

Dr. Charles L. Hovey, Eastern States Farmers Exchange, West Springfield, Mass., was chairman of a special session in which representatives from industry were invited to present information on new herbicides and improvements in older herbicides.

The effectiveness of Simazine and Atrazine as pre-emergence herbicides on corn in Delaware in 1959 was reported on by F. B. Springer, U. of Delaware, Newark. W. F. Meggitt, Rutgers University, New Brunswick, N. J., presented a progress report on herbicides for weed control in corn and soybeans; and R. D. Ilnicki, USDA and Rut-

gers University, discussed the effects of 2,4-D, 4 (2,4-DB), 2 (2,4-DP), and Silvex on wheat and spring oats,

The results of pre-emergence crabgrass control tests in Pennsylvania during 1959 were disclosed by J. M. Duich, Pennsylvania State University, University Park. R. G. Mower and J. F. Cornman, Cornell University, Ithaca, N. Y., discussed pre-emergence and post-emergence crabgrass control; and chickweed control in alfalfa seedings with pre-and post-emergence herbicides was the subject of a report by R. C. Wakefield, U. of Rhode Island, Kingston.

Some observations on the use of chemicals for seed-bed preparation on non-tillable land were made by R. A. Peters, U. of Connecticut, Storrs. S. N. Fertig, Cornell, presented 1959 results of chemical treatments on quackgrass.

Also on the program were Roger Latham, Pittsburgh Press, Pittsburgh, Pa., who discussed public reaction to herbicides; E. M. Rahn, U. of Delaware, who presented a program for determining losses due to weeds; and C. M. Switzer, Ontario Agricultural College, Guelph, Canada, who outlined the effectiveness and persistence in soil of certain new herbicides.

Fruit Fly Eradication Test

Isolated Pacific islands will be used soon to test new insect-control techniques involving male-fly sterilization and male-fly annihilation for eradication of both the melon and oriental fruit fly, the U. S. Department of Agriculture said last month.

Male-fly annihilation is a new method of possible eradication in which male flies are lured to a poisoned bait by a special attractant.

Entomologists Edward F. Knipling, Leroy D. Christenson, and Loren F. Steiner of USDA's Agricultural Research Service, along with representatives of the Navy and Trust Territory, selected Rota in the Mariana group, 30 miles from Guam, and the Bonin islands, 450 miles south of Japan, for the evaluation tests. Both eradication methods have been under investigation at the ARS Fruit Fly Laboratories in Hawaii and Mexico.

Destroy Celery Shipment

U. S. District Judge George Welch of Philadelphia last month ordered the destruction of 24,480 stalks of celery, He acted on a complaint that the celery, which was shipped from Sanford, Fla., had been treated with too much Parathion. None of the celery had reached the public.

Fiero Named CSMA President

George W. Fiero of Esso Standard Oil Co. was elected president of the Chemical Specialties Manufacturers Association at the group's 46th annual meeting in Washington, D. C., Dec. 7-10.

Allied Appoints Blanchard

George R. Blanchard has been named southeastern district field sales manager for agricultural chemicals by the Allied Chemical Corp.'s General Chemical Division.

Mr. Blanchard joined the company at its St. Louis, Mo., office in 1952.

SW, ESA Meeting Feb. 7-9

The Southwestern Branch of the Entomological Society of America will meet Feb. 7 to 9 at the Hilton Hotel in El Paso, Texas.

IMC Scholarship Program

The International Minerals & Chemical Corp., Skokie, Ill., has established a program of scholarship and fellowship awards in the fields of agriculture and mining. Called the "Louis Ware Scholarships for Outstanding Achievement in Agricultural and Mining Sciences," the program provides for twelve \$1,000 senior year scholarships to students interested in pursuing graduate studies in the areas of mining and agriculture. The six students in each area then would compete, during their senior year, for a \$3,000 annual fellowship leading to a doctorate degree.

The program was announced at a dinner last month honoring Louis Ware, IMC chairman of the board, on his 20th anniversary with the company.

Ken Blanchard Succeeds Frank Reid As Head Of C-VPFA



Kenneth Blanchard, (left) of Carter Insecticide Co., Wallace, N.C., was elected president of the Carolinas-Virginia Pesticide Formulators Assn. at the group's meeting last month. He succeeds Frank Reid (right), Quality Chemical Co., Wilson, N. C. See page 35. "Agricultural Chemicals", December, 1959.

Hercules Shifts Two





W. Coleman Edgar, (left) sales manager of the Agricultural Chemicals Division of the Hercules Powder Co.'s Naval Stores Department, has been appointed manager of the department's San Francisco district. This assignment includes the sales and development activities of the Agricultural Chemicals, Oxychemicals, and Pine Chemicals Divisions of the department in the West Coast states and Arizona.

visions of the department in the West Coost states and Arizona.

James H. Neal, (right) manager of the San Francisco district since 1952, will become sales manager of the Naval Stores Dept.'s Agricultural Chemicals Division. He joined Hercules in 1930 and served with the explosives and cellulose products departments before being named technical service representative for Naval Stores in 1939. He was appointed district manager in San Francisco in 1952.

Mr. Edgar, who joined Hercules in 1943, has been sales manager of the Agricultural Chemicals Division since August 1956.

Diamond Names Wilkerson

Martin F. Wilkerson, branch manager of the Diamond Alkali Co.'s southwest district sales office, has been named sales manager of the company's Chlorinated Products Division, Cleveland. He has been with Diamond since 1948.

Mr. Wilkerson is replaced at the southwest district sales office by Robert L. Walker.

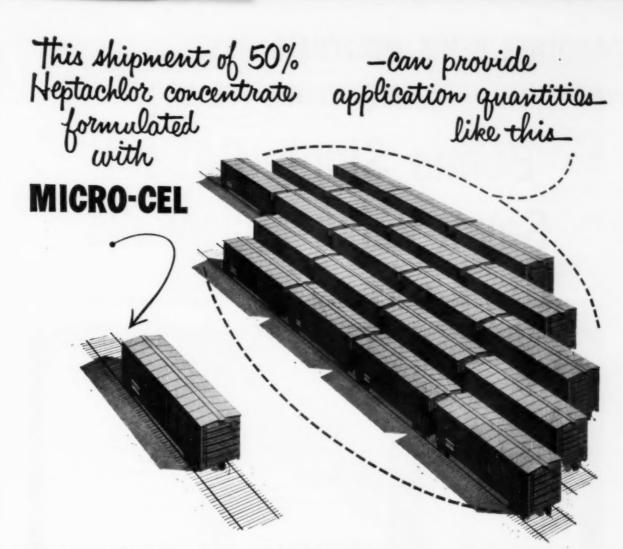
WARF Names Two

The Wisconsin Alumni Research Foundation, Madison, has appointed Robert F. Prier as assistant director of laboratories and John J. Birdshall as assistant to director of laboratories.

Their responsibilities will involve coordination of the laboratories' activities in research, consultation, and testing.

Cole Joins Beckman

Dr. Leland G. Cole has been appointed vice president-research for Beckman Instruments, Inc., Fullerton, Calif. He had been chief research chemist for Consolidated Electrodynamics Corp., Pasadena, Calif.



The advantages of formulating insecticide dusts at the higher concentrations obtainable with Micro-Cel* is graphically demonstrated by the freight cars above. One car of 50% Heptachlor when let down to a 2½% poison at the point of application produces the equivalent of 20 cars of insecticide in the field. Since Micro-Cel costs no more than many other diluents, the substantial freight savings mean extra profits for you.

PROVEN WITH MANY POISONS

Micro-Cel, a new line of synthetic calcium silicates developed by Johns-Manville, has been tested and proven at such high dust and wettable powder concentrates as:

75% DDT 70% Toxaphene 75% Aldrin 75% Dieldrin 50% Aramite 50% Chlordane

Experiments with other poisons are under way today.

IMPROVES FLOWABILITY

Micro-Cel—"the powder that flows like a liquid"—reduces caking, increases flowability and gives more uniform coverage with dry dusts. Other important properties include large surface area, small particle size and high bulking action.

Ask your Celite engineer to help you adapt Micro-Cel to your particular requirements, or mail coupon below.

*Micro-Cel® is Johns-Manville's new absorbent-grinding aid designed specifically for the insecticide formulator.

Johns-Manville MICRO-CEL

SYNTHETIC CALCIUM SILICATES

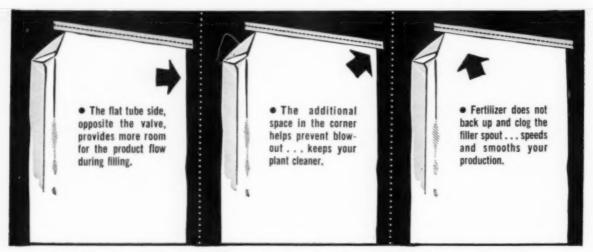
A PRODUCT OF THE CELITE DIVISION

In Canada: Port ☐ Please send ☐ furt interested in using	Box 14, New York 16, N.Y. Credit, Ontario her information: □ samples of Micro-Cel. I am Micro-Cel with the following poisons: r local representative contact me.
Name	Position_
Name	

ANOTHER BEMIS MULTIWALL FIRST... ANOTHER IMPORTANT BONUS FOR YOU...

Bemis Single-Gusset Sewn-Valve Multiwalls

The new Bemis Single-Gusset Sewn-Valve Multiwall will improve your packing performance, because

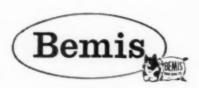


And there is a good chance this new Bemis Multiwall will cost you less, too. The additional usable space created by the flat tube corner often permits the use of a shorter bag, which would save you money. Your Bemis Man will check this possibility with you.

Bemis Single-Gusset Multiwalls Stack Perfectly, Too

You can palletize Bemis Single-Gusset Multiwalls easily and firmly . . . and pile them three pallet loads high, if you wish. They square up well. In fact, you have to look rather closely at stacked bags in the warehouse to determine whether they are single-gusset or two-gusset types.

General Offices—408 Pine Street, St. Louis 2 • Sales Offices in Principal Cities





Named By Bradley & Baker

Thomas J. White (right) has been appointed Fertilizer Sales Manager for Bradley & Baker. Formerly St. Louis area sales manager, Mr. White now is located in the company's New York office. Robert L. Borg (left) has replaced Mr. White at St. Louis.

In other moves announced by the company, Gerald E. Forbes has joined the Kansas City office to cover Colorado, Kansas, Missouri. Nebraska and southern Iowa; and Robert L. Harper has been assigned a territory comprised of Michigan, Ohio, and eastern Ken-

Raymond C. Brown Retires

Raymond C. Brown, chief of the Division of Forest Insect Research at the U. S. Forest Service's Northeastern Forest Experiment Station, Upper Derby, Pa., retired after 35 years in the federal service.

Chase Bag Names Wicks

Charles S. Wicks has been named manager of the Chase Bag Co. manufacturing plant in New Orleans. He succeeds D. H. Denholm, who has resigned to enter business in Alabama.

Sherman Joins Amchem

Aubrey E. Sherman, former district agriculturist in the Province of Alberta, Canada, has joined Amchem Products, Inc., Ambler, Pa., as a sales representative in Alberta and Saskatchewan.

Six Hercules Scholarships

The Hercules Powder Co., Wilmington, Del., has awarded six \$400 college scholarships in the National 4-H Entomology Awards Program. The scholarships were awarded to: Lynn Gould, Roseville, Calif.; Dick Juhl, Lakewood, Colo.; Gerald R. Flynn, Grand Rapids, Mich.; Rose Allen Duncan, Hartsville, Tenn.; Herky Killingsworth, Paducah, Texas; and Morgan Morrison, Arlington, Va.

Florida Soil and Crop Meeting Reviews Past Twenty Years

M EETING at Gainesville, Florida, in December, members of the Soil and Crop Science Society of Florida pursued the theory that it is wise to look back now and then to see where you have been so that you can better plan your course for the future.

"Twenty Years of Progress in Research, Teaching, and Extension in Soils and Field Crops in Florida" was the theme of the Society's 19th annual meeting.

Retiring president of the Society, P. H. Senn, Head, Department of Agronomy, College of Agriculture, University of Florida, presided over the three-day meeting which was attended by about 200 members plus a number of University students.

J. R. Henderson, Agricultural Extension Service at the University of Florida, was advanced from vice-president to president of the Society; and W. H. Chapman, North Florida Experiment Station at Quincy, Fla., was elected vice-president.

R. V. Allison, Everglades Experiment Station, Belle Glade, Fla., was re-appointed to begin his 20th term as secretary-treasurer.



(Left to Right) J. R. Henderson, new president; P. H. Senn, retiring president; and R. V. Allison, who was re-appointed secretary-treasurer of the Soil and Crop Science Society of Florida. All three men are charter members.

Most of the 1200 members are actively engaged in some form of agricultural research or in the dissemination of information gained from experiments. The Society also has about 160 sustaining members comprised mainly of companies engaged in the manufacture, sale, or distribution of agricultural supplies or products.

Papers presented this year ranged from such advance topics as crop improvements through mutations produced by gamma irradiation, to summaries of experiments to determine soil reaction to continual fertilizing practices over a period of twenty years.

Forms Multiwall Division

Multiwall bag operations of the West Virginia Pulp and Paper Co., New York, have been given full divisional status. Victor S. Luke has been named manager of the new Multiwall Bag Division, which operates plants at New Orleans, St. Louis, Wellsburg, W. Va., and Torrance, Calif.

The new division is divided into two regions, the northern region with headquarters in New York, and the southern region with headquarters in New Orleans.

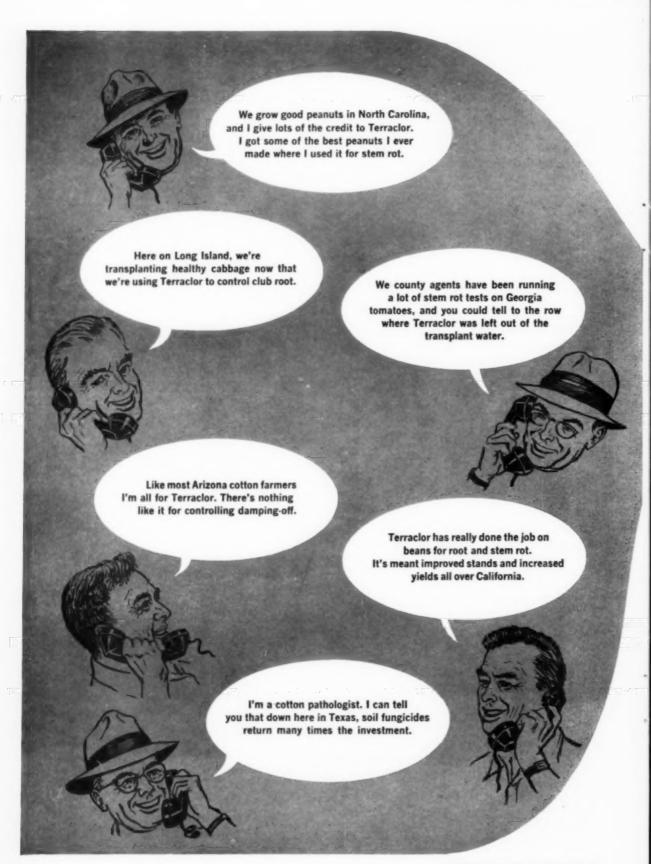
Fire Ant Baits

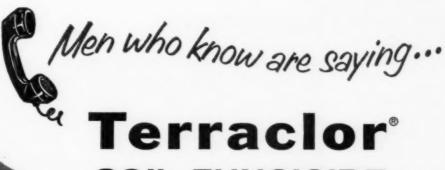
Entomologists of the Auburn Experiment Station, Auburn, Ala., have developed a fire ant control method involving the use of poison baits. Sidney Hays and Dr. F. S. Arant, zoology-entomology department, report that peanut butter containing one-eighth per cent Kepone, a stomach poison, was the most effective of many bait preparations tested. Four to six pounds of the material per acre resulted in complete kill of all fire ants in test areas up to 10 acres in size. The peanut butter-Kepone bait was loaded into large soda straws with a grease gun and broadcast on the plots.

Hazleton Adds Building

Hazleton Laboratories, independent biological research firm, has added 10,000 square feet of research facilities with a new building at its headquarters in Falls Church, Va.

Construction of another 12,-000-square-foot building is scheduled for next spring.





SOIL FUNGICIDE

Gives protection, bigger yields, greater profits

Terraclor pays off on:

COTTON: 25-30% of total disease losses are caused by seedling diseases. Replanting costs \$5-15.00 per acre, plus loss of pre-emergence herbicide previously used. Terraclor may in-



crease yields and return the grower more than 15 times his investment through uniform stands of better grade cotton.



CABBAGE, CAULIFLOWER: Severe club root infection can take a field out of crucifer production entirely. Terraclor control has provided 3-5 ton per acre increases for a

return of 10-30 times the investment. Terraclor also controls black root or wire stem.

PEANUTS: Faced with the threat of a 50-60% crop loss, growers can realize Terraclorincreased yields of as high as 350-500 lbs. per acre of clean peanuts - free from soil. This return is many times the cost of the chemical



invested for control of stem and root rot (Southern blight).



BEANS: Root and stem rot losses run as high as 30-40%. Terraclor may increase yields by 200-300 lbs. per acre and return growers 10-15 times the cost of treatment. Terraclor also controls white mold.

TOMATOES, PEPPERS: Stem rot (Southern blight) can cut production 30-60%, depending on severity. Terraclor treatment can return 10-20 times the investment by increasing yields 1/3 to 1/2.





LETTUCE: Growers have lost 25-50% of their crop to leaf drop and bottom rot. Terraclor may increase yields by 1/2 for a profit far exceeding the chemical cost.

Also:

POTATOES	(Scab, Rhizoctonia)
WHEAT SEED	(Common Smut or Bunt)
GARLIC	(White Rot)
ALFALFA, CLOVER .	(Crown Rot)
FORMULATORS - Get	complete information on Terraclor for
control of soil-borne di	iseases. Terraclor is available as 75%



OLIN MATHIESON CHEMICAL CORPORATION

INSECTICIDE PRODUCTS DEPARTMENT Fresno, Calif. . Baltimore, Md. . Denver, Colo. . Dallas, Tex. New York, N.Y. . East Point, Ga.

TERRACLOR® is a trademark

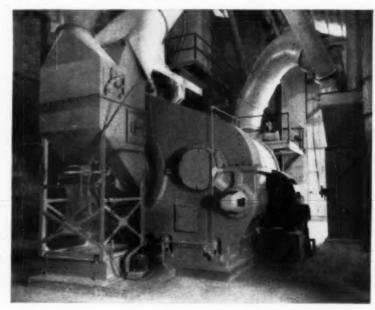
LOWER

production costs with a

KENNEDY

air swept grinding system

The Kennedy Air Swept Tube Mill Grinding System is the ultimate in high production and low operating cost. The experience of the many owners of Kennedy Mills has shown that the cost of this mill can be paid in a few years with the savings in maintenance and power alone!



Kennedy 10' x 15' Integral Gear Drive Air Swept Ball Tube Mill and #93 Exhauster Fan in service at the American Agricultural Chemical Co., Pierce, Florida.

HERE ARE A FEW OF THE REASONS FOR THE ECONOMY AND POPULARITY OF KENNEDY PULVERIZING SYSTEMS...

REDUCED MAINTENANCE • Tramp iron and other foreign material cannot damage the system. Years of operation are assured before parts (except for grinding balls) require replacement.

CONTINUITY OF OPERATION • Lubrication and replacement of grinding media is accomplished without shutdown or interruption of production.

MINIMUM POWER • Careful design and construction and a proven pressure lubrication system insure a high mechanical efficiency.

HIGHER PRODUCTION • Single grinding units are built for capacities to 100 tons per hour. Production and fineness remain constant, month after month.

LOWER OPERATING COSTS • Dependability of equipment and reliable automatic feed control assure high production with minimum manpower.

CAPITAL SAVINGS • No magnetic separators are required. KENNEDY units require less structural steel and floor space per ton of product.

FLEXIBILITY OF DESIGN • KVS Air Swept Grinding Systems are available for a wide range of capacities and products.



Send now for full details on KENNEDY Size Reduction Equipment.

KENNEDY VAN SAUN

MANUFACTURING & ENGINEERING CORPORATION
405 PARK AVENUE, NEW YORK 22, N.Y. FACTORY; DANVILLE, PA.

Niagara To Expand Plant

The Niagara Chemicals Division of Food Machinery & Chemicals Corp., Middleport, N. Y., is planning to set up facilities in its South Haven, Mich., warehouse for the production of a wide range of pesticides.

In addition to the plant, Niagara's regional headquarters will be located at South Haven to serve Michigan, Ohio, and parts of West Virginia and Kentucky.

Arizona Fertilizer Conf.

The latest developments in University of Arizona crop fertilization research will be highlighted in two panel discussions at the annual Arizona Fertilizer Conference, Jan. 20 and 21, at the university's campus in Tucson.

The first panel, on field crop research, will be moderated by Dr. T. C. Tucker and the second one, on vegetable and fruit crops, by Dr. Fred Turner Ir., both of the university's department of agricultural chemistry and soils. Other features on the conference are a third panel, moderated by Sam Madsen, Olin Mathieson Chemical Co., Phoenix, on the basis for fertilizer recommendations on Arizona crops; a talk on cotton fertilization planning from a grower's viewpoint; and a talk on fertilizer formulation and control by Dr. Wallace H. Fuller, head of the university's department of agricultural chemistry and soils.

Make Clupak on West Coast

Crown Zellerbach Corp. has just begun the first west coast production of the new paper, Clupak, at its Antioch, California mill. Intended primarily for the multiwall sack and converting grades markets, Crown Zellerbach's Clupak paper is being run on its Number 1, 260-inch machine at Antioch, which has an estimated production capacity of approximately 300 tons a day.

Crown Zellerbach is the eighth paper maker to go on line with Clupak paper production since the first of the year. International Paper Company, West Virginia Pulp and Paper, Union Bag-Camp Paper Corp., Albemarle Paper Company, Continental Can Company and St. Regis Paper Company are already in production in this country and St. Lawrence Corp., Ltd. now produces the paper in Canada.

Two Named By IMC

Fred J. Jilek has been named inventory control coordinator and Henry F. Eizenga has been named administrative staff assistant in the Skokie, Ill., headquarters of the Plant Food Division of the International Minerals & Chemical Corp.

Mr. Jilek joined IMC as a cost accountant in 1942 and, since 1952, has been assistant to the general manager of the division. Mr. Eizenga joined IMC in 1952 and was a division analyst in the profit planning department.

Travel Grants Available

The National Science Foundation has made funds available to the Entomological Society of America for the purpose of partially defraying travel expenses of a limited number of U.S. scientists to the XIth International Congress of Entomology in Vienna, Austria, Aug. 17 to 25, 1960. The grants will cover round-trip air-tourist fare from the scientist's home to Vienna.

Application blanks are available from the Entomological Society of America.

Planning Sevin Plant

The Union Carbide Division of the Union Carbide Chemicals Co., New York, is reported to be planning to build a large-scale Sevin insecticide plant at Institute, W.Va. Carbide now is producing Sevin with existing equipment at its Institute and South Charleston plants.

Pesticide Course is Added To The Curriculum at N. C. State

A new college course offering students training and background in the pesticide industry has been added to the curriculum of the School of Agriculture, North Carolina State College, Raleigh, N. C. Developed around the theme of a New Concept of Agriculture, a tridepartmental major in Plant Protection has been developed to train students for developmental and promotional aspects of the pesticide chemical industry.

The program provides fundamental knowledge in the main phases of the pesticide industry: insecticides, nematocides, fungicides, and herbicides, as well as in other basic principles used to control pests. The main background for such training includes chemistry, botany, zoology, and soil agronomy, plus a well rounded knowledge of the humanities, marketing, salesmanship and economics.

The committee planning the Plant Production Major first surveyed the pesticide industry: manufacturers, formulators, processors, government agencies – asking for their suggestions, opinions, and particularly whether they felt such training would be desirable. Almost all concerns contacted encouraged the initiation of the program, and about 100 companies and agencies indicated that graduates from this major would be desired as employees.

N. N. Winstead, associate professor of plant pathology at North Carolina, and chairman of the curriculum committee, reported to Agricultural Chemicals that general response to the new major has been very favorable, and he hopes more students will elect the curriculum when they realize it is available. Circulars and folders are being distributed to all high schools in North Carolina and to all incoming freshmen.

Folders describing the course are available to those in the pesticide industry desiring them. They can be obtained from Mr. Winstead or the other members of the committee. These include W. M. Lewis, field crops department, and F. E. Guthrie, entomology.

International Minerals cuts costs, bag breakage with **WONDERWALL**



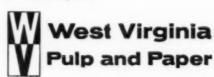
"With 70 plants in 30 states, bag breakage was a major problem," relates S. Arthur Fournier (standing), Purchasing Agent, Central Buying, for International Minerals & Chemical Corporation, Skokie, Illinois. "Since switching to Wonderwall bags, breakage has been reduced up to 90% on shipments from plants using only Wonderwall."

Customer Service Manager Joseph J. Bozis explains: "We tested the bag. We loaded cars half with Wonderwall, half with conventional kraft bags. In every examination on arrival at destination Wonderwall breakage was substantially less than ordinary kraft multiwalls."

> *Clupak, Inc.'s trademark for extensible paper, manufactured under its authority.

Wonderwalls prove better because they're made with Kraftsman Clupak* paper, the tough, impact-resisting kraft with the built-in stretch—pioneered by West Virginia.

Whether you pack fertilizer, cement, flour, feed or chemicals, tougher Wonderwall can save you money while reducing bag breakage. For the whole story, write Multiwall Bag Division, West Virginia Pulp and Paper Company, 230 Park Avenue, New York 17, N. Y.



Join Geigy Sales Staff



M. A. Priola (left) has joined Geigy Agricultural Chemicals, Division of Geigy Chemical Corp., Ardsley, N. Y., as sales representative in Nebraska. He had been with the Shell Chemical Corp.

Corp.

Robert E. Holland (right) has been appointed to the southern sales staff and will represent Geigy in South Florida. Mr. Holland formerly was with the Citrus Experiment Station, Lake Alfred, Fla. and also had been pest control operator in the Department of Entomology, University of Florida, Gainesville.

Clem Named VP of Marketing

Albert H. Clem has been named to the newly-created office of Vice-President of Marketing by the Pennsalt Chemicals Corp., Philadelphia. He had been general manager of Pennsalt's Chemical Specialties Division and is replaced in that post by George R. Lawson.

WSA To Meet In Denver

Leading authorities from three nations will address members of the Weed Society of America during a general session at the society's third biennial meeting, Feb. 22 to 25, at the Cosmopolitan Hotel, Denver, Colorado.

"Weed Control Research-Past, Present, Future" will be the title of an address by Weed Society of America president, Dr. A. S. Crafts, Botany Department, U. of California, Davis, to open the general session. Other speakers include: Dr. E. K. Woodford, Department of Agriculture. Oxford, England, who will speak on weed control research in England; Dr. Hans Gysin, director of research, Geigy Chemical Corp., Basle, Switzerland, whose paper will be titled, "The Role of Chemical Research in Developing Selective Chemical Weed Control Practices:" and Dr.M.W. Parker, director of the crops research division, ARS, U. S. Department of Agriculture, Beltsville,

Md., who will discuss organizational needs in the field of weed control.

In addition to the general session, 14 sectional meetings are scheduled.

U. K. Fertilizer Use Rises

Although final figures for the United Kingdom's total consumption of fertilizers during the year 1958-59 are not yet available, preliminary assessments indicate that the upward trend has continued, although the rate of increase was not as high as the previous year.

A contributing factor was the difficult harvest of 1958, while the chief contribution to the increase was additional consumption of nitrogen and potash with phosphates remaining more or less static. The increased use of high grade granular compound fertilizers has continued.

Carbide Names Two

T. P. Finn has been named eastern regional sales manager, Crag Agricultural Chemicals, and Francis A. Pastor has been named product manager, Crag Glyodin, by the Union Carbide Chemicals Co., Division of Union Carbide Corp., New York.

Yale & Towne Names Wulf

George A. Wulf, assistant to the senior vice president of the Yale & Towne Manufacturing Co., Philadelphia, has been appointed manager of the Philadelphia Materials Handling Sales and Service Branch of Yale Materials Handling Division.

The Philadelphia branch serves southern New Jersey, eastern Pennsylvania, Maryland, Delaware, the eastern shore counties of Virginia and the eastern tip of West Virginia.

Pumpkin Caterpillar Found

The presence in Florida of the pumpkin caterpillar has been confirmed by the U.S. Department of Agriculture. Entomologists believe that the insect—a foreign pest of cucumbers, melons, squashes, and other members of the gourd family—may have been present in Florida for several years.

The pumpkin caterpillar is widespread throughout central and southern Africa, southern and eastern Asia, Australia, and many of the Indian and Pacific Ocean islands. It is considered to be an important pest of members of the gourd family in India and Australia.

Personnel Changes Announced by Frontier Chemicals

Melvin E. Clark, vice president-marketing for Frontier Chemical Company—a division of Vulcan Materials Company—has recently announced a number of promotions in his department.

Jerry C. Walker has assumed the newly- created position of sales manager-chemicals. Formerly field sales manager, based at Midland, Texas, Mr. Walker has moved to Wichita.

The new assistant sales manager-chemicals is John B. Childress, whose primary assignment will be the direction of Frontier's sales activities through its field representatives.

Richard H. Barton, appointed product manager-chemicals, is responsible for price quoting, order handling, liaison with manufacturing facilities and generally rendering headquarters service to customers.

The job of sales managergrain fumigants went to Howard A. Stedman, whose duties include field sales, order handling, customer service and liaison with the grain fumigants manufacturing facilities.

E. A. Guldaman, newly appointed traffic coordinator, has moved up from the position of assistant to the traffic manager. R. W. Remmert, former manager of traffic and sales service, has been transferred from Wichita to Birmingham, Ala., where he has been assigned to the Traffic Department of Vulcan Materials Company, as manager of freight rates and charges.

India Orders Fertilizer

The Indian government. through the India Store Department in London, has placed an order with two West German firms for large shipments of ammonium sulfate fertilizer. The orders were placed with Ruhrstickstoff AG of Bochum and with Dungemittel GmbH, of Ludwigshafen-on-Rhine.

List Tolerance Amendments

The Food and Drug Administration of the U.S. Department of Health, Education, and Welfare has published, in the Federal Register, amendments to tolerances for residues of seven pesticides.

Among the pesticides and tolerances are: Dodine, 5 parts per million in pears and sour cherries; Ethion, 1 ppm in beans, melons, onions, strawberries, and tomatoes: sodium 2.2 - dichloropropionate. from I ppm on apricots and plums to 75 ppm on flaxsced; ethylene oxide, 50 ppm on copra and whole spices; and sodium diethyldithiocarbamate, 25 ppm on melons. and 0.0-diethyl 0- (2-isopropyl-1methyl-6-pyrimidinyl) phosphorothioate, 1 ppm on olives and 0.75 ppm on vegetables.

Hercules Appoints Pierce

Henry F. Pierce has been appointed assistant sales manager of the Agricultural Chemicals Division, Naval Stores Department, of the Hercules Powder Co., Wilmington. Del. Mr. Pierce had been senior technical representative of the division since October 1956.

West Virginia Sales Manager

J. R. Jones has been appointed sales manager for the Kansas City, Mo., district of the multiwall bag division of the West Virginia Pulp and Paper Co. He had been sales representative in western Missouri and has been in the multiwall bag business for 27 years.

Also: Guthion, 2 ppm on various fruits and 0.5 ppm on cottonseed;

IMC Names Six

The Plant Food Division of International Minerals & Chemical Corp. Skokie, Ill., has announced six personnel changes in sales and production in its Woburn, Mass., and Cincinnati, Ohio, districts.

James E. Sovocol, a sales representative in Buffalo, New York. has been named district sales manager at Woburn. He succeeds F.R. Witham, who has been named northeast sales manager for specialty products.

Cincinnati, G. James Leonhardt, sales supervisor at Chicago Heights, Ill., has been promoted to district sales manager at Cincinnati. John L. Medbery, assistant superintendent at the IMC fertilizer and sulfuric acid plants at Lockland (suburban Cincinnati), has been promoted to superintendent. He succeeds C.A.Willenbrink, scheduled for retirement in 1960, who will handle special assignments in the Lockland area office

Robert L. Wright has been named area credit manager for the sales districts at Geenville and Lockland, and William J. Boston, general foreman at Lockland since 1956, has moved up to assistant superintendent.

Insecticide Plant In Ghana

An insecticide plant, with a capacity of 500,000 gallons per year of P.P. Kumakate (a gamma B.H.C. insecticide) for use against the capsid bug on cocoa, has opened at Tema, Ghana. The product will be sold formulated, ready for spraying.

API Grant to N.C. State

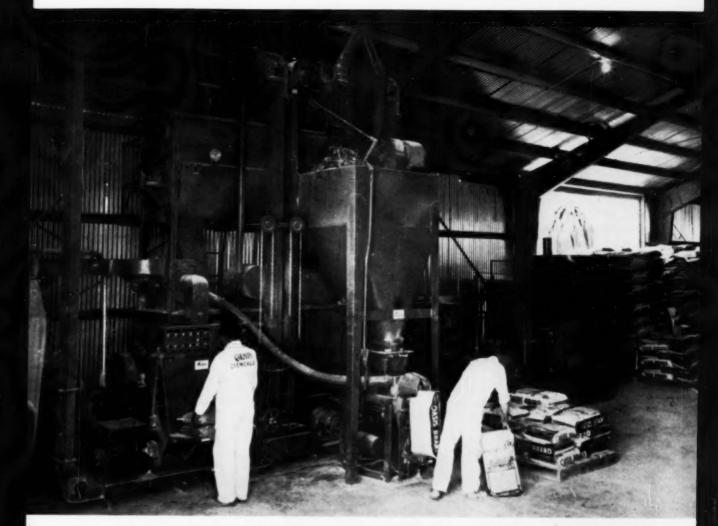
Through an \$8,250 grant from the American Potash Institute, Washington, D.C., the soils department of North Carolina State College has begun a study on the role of potassium in helping plants utilize carbon from the air. Dr. W. A. Jackson and Dr. N. T. Coleman, both of the soils department staff, are directing the 3-year research project.



Sift-proof because it double-folds, heat seals and glues on heavyweight coated or lined paper bags. Double-folds and glues only on plain kraft bags. Strong because the second fold is glued to the first adding shipping and carrying strength to powder tightness. And the closing operation is continuously automatic!

WRITE FOR FREE BROCHURE TODAY!

42 East Second Street, Mineola, N. Y. - Ploneer 6-6230



IF YOU MIX, GRIND, OR BLEND-POULSEN'S R. T. R.* UNI-BLENDER SOLVES MANY OF YOUR PROBLEMS

In the field of fertilizers and insecticides, the Poulsen Uni-Blender is our standard unit-a plant that's *Ready-To-Run. It mixes, elevates, grinds, and bags. Impregnates liquids with diluent mixes.

If your product deteriorates from long delays in shipping, you want to deliver a fresh product . . . the Uni-Blender can do it!

If you want to blend concentrate to field strength . . . if you would like to switch from custom-mixed to standard . . . Uni-Blender can do it!

This unit can handle four to six, 1200 to 1500 lb. batches of field strength dust per hour. Other capacities are available.

Requires only 9' by 12' floor space and 16' headroom. Factory pretested and ready to go to work for you just two days after delivery.

We design and build complete plants If you need specially designed equipment, tell us the problem. There always seems to be a solution.



Engineers and manufacturers of materials processing and materials handling equipment

> 2341 East 8th Street Los Angeles 21, California

PARTIAL LIST OF TYPICAL USERS DOMESTIC

Arizona Fertilizers, Inc. Mathieson Chemical Corp Niagara Chemical Div. (FMC) Miller Products Co. Stauffer Chemical Co.

American Potash & Chemical Co. Cotton States Chemical

Pennsalt Mfg. Co. of Wash. Thompson-Hayward Chemical Co.

lide Petroleum Prod. Co. Diamond A!kali Co.

Pennsalt International Corp. Stauffer de Mexico, S.A. Niagara Chemical Division Tropical Agriculture, S.A. Culiacan, Mexico Culiacan, Mexico Havana, Cuba Rio De Janeiro, Brazil Geigy Do Brasil, S.A. DuPont (Peru) S.A.

Compania De Petroleo Shell de Columbia Barranquilla, Colombia Allied Chemical Services Ltd. Calgary, Canada Alianca Commercial

De Anilinas Bayer Agro Chem Corp. Sao Paulo, Brazil Bombay, India

Phoenix, Arizona

Phoenix, Arizona Richmond, Calif. Portland, Ore.

Richmond, Calif.

Los Angeles, Calif.

West Monroe, La.

Portland, Oregon

Lubbock, Texas

Edenburg, Tex. Cleveland, Ohio

Mexico City

Callao, Peru

GENTLEMEN: Please send me your technical bulletin about the standard unit Uni-Blender.

NAME COMPANY ADDRESS

STATE

Continental Conveyor Formed

Continental Conveyor and Equipment Co., a new corporation composed principally of personnel of the Continental Gin Co., Birmingham, Ala., has completed purchase of the Industrial Division of Continental Gin Co.

Nelson J. Kemp is chairman of the new corporation, George R. Maples Jr. is president, and Raymond C. Kirkpatrick is vice president. Mr. Maples had been general manager of the Industrial Division

fertilizer throughput.

of the Gin Co., while Mr. Kemp

ESA Moving To College Park

Effective Jan. 15, the address of the Entomological Society of America will be 4603 Calvert Road, College Park, Maryland. The ESA had been located in Washington,

was vice president and finance director and Mr. Kirkpatrick was comptroller of the parent company. Continental Conveyor plans to build a plant in Winfield, Ala.

Demont W. Galbraith, president of Agriform of Northern California, Woodland, was elected president of the California Fertilizer Association at the group's annual meeting in San Francisco, Nov. 8 through 11. Other officers named for 1960 were James F. Sloan, J. F. Sloan Co., Salinas, vice president; Lawrence M. Roberts, Shell Chemical Corp., San Francisco, secretary; John N. Williams, General Fertilizer and Supply Co., Chula Vista, treasurer; and Sidney H. Bierly of Sacramento was re-elected general manager.

CFA Elects Galbraith

Cotton Conf. Jan. 14-15

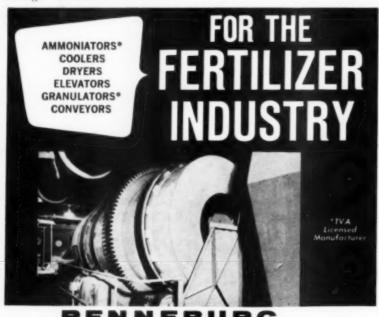
A panel discussion about cotton pest control and harvest aid guides for 1960 will be moderated by G. C. Cortright Jr., a cotton producer from Rolling Fork Miss., at the 1960 Beltwide Cotton Production - Mechanization Conference, Jan. 14-15, at the Peabody Hotel, Memphis, Tenn. The panel will cover diseases, weeds, insects, defoliation, and application equipment.

Among other topics to be discussed are: insect resistance to insecticides, by Dr. C. W. Kearns, U. of Illinois; a research program on the boll weevil, by Dr. E. F. Knipling, ARS, USDA; and the agricultural weather program in the Mississippi Delta, by J. A. Riley, agricultural meteorologist, Stoneville, Miss.

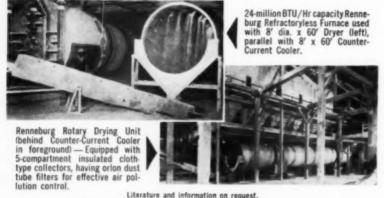
ACS Names Hignett

Travis P. Hignett, chief of the Tennessee Valley Authority's applied research branch, Wilson Dam Ala., has been elected chairman of the American Chemical Society's Division of Fertilizer and Soil Chemistry for 1960. He succeeds M. D. Sanders of Swift & Co., Chicago.

John O. Hardesty of the U. S. Department of Agriculture, Beltsville, Md., was named vice-chairman of the ACS division and Dr. Lawrence B. Hein of the Blockson Chemical Co., Joliet, Ill., was elected secretary-treasurer.



7'6" dia. x 15' heavy duty Continuous Combination Ammoniator-Granulator — With 40 HP motor and Renneburg exclusive motorized cam-actuated knockers. Unit handles 70 tons per hour granular



EDW. RENNEBURG & SONS CO.

2639 Boston Street, Baltimore 24, Md.

Pioneers in the Manufacture and Development of Processing Equipment for over 85 years.

Wisconsin Control Conf.

The 14th annual Pesticide Conference with Industry is being held Jan. 6 and 7 at the Wisconsin Center in Madison, Wisconsin. The conference is sponsored by the University of Wisconsin College of Agriculture.

Among the speakers will be: D. R. Peterson, professor of agronomy, "Precautions for Using Aminotriazole and Dalapon on Field Crops and Pastures"; L. P. Lichtenstein, professor of entomology, "Factors Responsible for Chemical Changes of Aldrin and Heptachlor in Soils"; and K. P. Bucholtz, professor of agronomy, "Use of Simazine and Atrazine for Weed Control in Corn." Also scheduled are panel discussions of insect and disease problems of fruits and vegetables and a talk on soil fumigation for nematode control by G. D. Griffin, USDA.

Schulze Joins Hooker

Appointment of Arthur P. Schulze, of Cleveland, Ohio, to the public relations department of Hooker Chemical Corporation, Niagara Falls, N. Y., is announced by R. Wolcott Hooker, senior vice president. Mr. Schulze will be engaged in all phases of the company's broadening corporate public relations program, reporting to Thomas H. Trimble, manager of public relations.

Mr. Schulze comes to Hooker from Diamond Alkali Company, Cleveland, where he was manager of public relations and advertising for nearly five years.

Central American Plant

The new Central American common market's first major industrial project reportedly will be a complex fertilizer plant to be built in Costa Rica or El Salvador by Fertilizantes de Centro America (Ferticas).

Fifty per cent of the company is owned by International Development & Investment Corp. (Nassau, Bahamas), which is a joint venture of Chemical and Industrial Corp., Cincinnati, and Phoenix-Rheinrohr, Dusseldorf, West Germany. Central American financial groups own the other 50 per cent interest in Ferticas.

Cotton Council Feb. 8-9

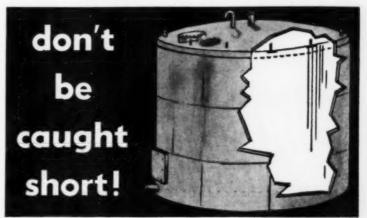
Representatives of the American Cotton Industry from the 18 cotton-producing states will attend the 22nd annual meeting of the National Cotton Council at the Statler-Hilton Hotel in Dallas, Texas, Feb. 8 and 9.

Move Hercules Office

The Greenville, Miss., office of the Hercules Powder Co. now is located in the Rode Center Building, corner of Highway 82 East and Fairview Avenue.

Named Chemagro Officers

The Chemagro Corp., Kansas City, Mo., has elected Charles V. Jones, treasurer; Allan R. Bennett, assistant treasurer; and Robert W. Dammann, secretary.



Add Acid Storage Now At 1/4 Normal Cost!

Now you can have all the storage you need for phosporic acid, ammonium nitrate, other acids and corrosive liquids.

You can convert or add ordinary, inexpensive tanks made of mild steel or even wood by simply installing amazing FLEXI- LINERS. These flexible, laminated plastic liners fit in tanks of any size or shape, hold from 100 to 30,000 gallons. Use them with tanks of any type . . . vertical, horizontal, or even opentop design. All outlets are built right in the liner.

FLEXI-LINERS

for all non-pressure storage

FLEXI-LINERS cost only one-fourth as much as highpriced stainless steel or rubberlined vessels. You save even more by installing them easily yourself or with the help of our factorytrained servicemen.

trained servicemen.

Best of all, you'll get years of trouble-free performance from

every FLEXI-LINER. Widely used in the chemical industry, FLEXI-LINERS have already built a reputation for long-life and economy.

Don't be caught short next season when FLEXI-LINERS can solve your extra storage problem at a 75% saving.

Write for FREE FOLDER and Price List

FLEXI-LINER COMPANY

359 EAST MAIN STREET . PHONE 8-4365 . DECATUR, ILLINOIS

Penick Branch in 25th Year

The Chicago branch of S. B. Penick & Co., New York, celebrated its 25th anniversary recently. Over 50 people, including present and former members of the staff, attended a party held to commemorate the occasion.

The Chicago branch was established in 1934 by Harold A. Meyer. In 1946 Mr. Meyer rejoined Penick's home office in New York to supervise general sales of botanical and allied products. Since that time Ralph A. Olson has been in charge of the Chicago operations. Both Mr. Meyer and Mr. Olson are vice-presidents of the company.

New Niagara Department

Niagara Chemical Division, Food Machinery & Chemical Corp., Middleport, N. J., has formed a new Marketing Research Department. J. Lloyd Poland is manager and Ralph Freund is market analyst for the new department.

ARSENATES · COPPERS · CAPTAN · RYANIA

METHOXYCHLOR · ROTENONE · MALATHION

CHLORANIL · DICHLONE · LINDANE · ENDRIN

ZINEB [][][][][][] DDT

BHC [][][][][] NABAM

HEPTACHLOR · TOXAPHENE · PYRETHRINS

PARATHION · FERBAM · ALDRIN · DIELDRIN

STREPTOMYCIN · SABADILLA · CHLORDANE

GOES WITH ALL TOXICANTS . . .

You need little or no stabilizer when formulating dusts with the newer pesticides when you use PYRAX ABB as the diluent.

The unusual combination of chemical inertness, neutral pH, dry flowability and low moisture content has made PYRAX ABB the logical choice for formulating the commonly used toxicants.

When you dilute any toxicant

with PYRAX ABB, you reduce costs due to easier handling, better coverage, and simpler formulation.

The excellent compatibility of PYRAX ABB has made it the most widely used Pyrophyllite in the agricultural field.

Write today for compatibility data on PYRAX ABB and toxicants.

Ø

R. T. VANDERBILT CO., SPECIALTIES DEPARTMENT 230 Park Avenue, New York 17, N. Y.

()	Please	send	Compatibility	Data.	State	Application_	
N	am	e						

p. 9

API Regional Director

Dr. Roger P. Humbert, head of the department of agronomy of the Hawai-



ian Sugar Planters
Assn. Honolulu,
has joined the
American Potash
Institute as director of its Western
Region He succeeds M. E. McCollam who retired Jan. I after
24 years with the
Potash Institute.

Before heading the agronomy work of Hawaii's sugar planters, Dr. Humbert had been head of the agricultural division of the Saratoga Laboratories in Saratoga Springs, N. Y., and head of the soil genesis section of the USDA Plant Industry Station at Beltsville, Md.

To Study U.S. Developments

A. Luxembourg, manager of I. Luxembourg Chemical Corp. Tel-Aviv, Israel, has travelled to the United States to study new developments in insecticides, fungicides, and herbicides.

U. S. firms interested in introducing new agricultural chemicals to Israel can contact Mr. Luxembourg through the secretary of the Israel Supply Mission, 250 West 57th Street, New York 19. Mr. Luxembourg arrived in the U. S. late last month.

FDA Tolerance Booklet

"Protecting Crops and Consumers," a booklet prepared by the Food and Drug Administration's Pesticide Control Program, is being distributed by the National Agricultural Chemicals Association. The booklet is aimed at growers and shippers and discusses tolerance provisions of the Federal Food, Drug, and Cosmetic Act administered by the FDA.

The booklet emphasises the importance to the grower of reading the label and suggests ways in which shippers can insure that they do not ship a product containing excessive residues.

Bagley Joins Carbide

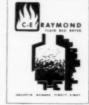
Richard W. Bagley has joined Crag Agricultural Chemicals, Union Carbide Chemicals Co., Division of Union Carbide Corp., New York. An entomologist, Mr. Bagley will assist in the development of Sevin insecticide.

Fluid Bed Dryer Bulletin

The Raymond Division of Combustion Engineering, Inc., Chicago, has

prepared a bulletin that lists the advantages, design, and operation of C-E Raymond Fluid Bed Dryers.

Among the advantages listed for the fluid bed drying system are minimum degrada-



tion of product, high thermal efficiencies, small space requirements, and large range of capacities. Fluid bed drying features gentle handling of a product and extended retention time to reach extremely low final moistures.

Herbicide Wall Chart

A wall chart that outlines recommended weed control methods has been published by the Stauffer Chemical Co., New York. Included on the chart are data on major crops (wheat, barley, oats, corn), chemicals, application rates, and weeds. The chart is available from the company.

Belt Weigher Bulletin

A pneumatically-operated Belt (Stream) weigher for the continuous weighing of dry materials at low to medium rates is the subject of a bulletin offered by the Omega division of B-I-F Industries, Inc., Providence, Rhode Island.

Soiltest Equipment Catalog

Soiltest, Inc., Chicago, manufacturer of testing equipment, has published its largest catalog of

Equipment, Supplies, Bulletins

equipment for testing soils, sand, gravel, and similar materials. Containing 316 pages, the 1960 catalog describes over 3,400 different items ranging from a small pocket-sized soil penetrometer to completely equipped mobile laboratories.

Physical Properties Booklet

A 28-page Physical Properties Booklet, describing more than 400 synthetic organic chemicals, has been published by the Union Carbide Chemicals Co., Division of Union Carbide Corp., New York.

The booklet contains information on applications, physical properties, and shipping data. It is available from the company.

Centrifugal Chemical Pumps

A new line of centrifugal chemical pumps with a 14-gauge stamped and drawn housing made in the corrosion-resistant alloy most suited to the user's requirements has been developed by the R. S. Corcoran Co., Joliet, Illinois.

In addition to choice of alloy, users may specify impeller design, mechanical seal and motor style.

Linck Animal Repellent

O. E. Linck Co., Inc., Clifton, N.J., is marketing a deer and rabbit repellent that is a combination of Thiram and plastic binders. Called Tat-Go, the product can be sprayed, brushed, or swabbed over potential feeding surfaces of animals. At highest concentration, one treatment will last up to ten months.

Swift Surfactants Booklet

A new 24-page bulletin describes the Swift line of synthetic surface active agents and detergents for industry.

Identified by the brand name "Solar," these products include various forms of liquid concentrates for wetting, emulsification, suspension, dispersion, etc., and solid materials for use as detergents, wetting agents, emulsifiers, etc.

The bulletin is available from Swift & Co., Soap Department, Chicago 9, Illinois.

Case Tractor Shovel Folder

A 16-page catalog detailing features and performance capabilities of the W-10 Terraload'r is being offered by the J. I. Case Co., Racine, Wisc.

2 Kraftpacker Attachments

The Kraft Bag Corp., sales agents for the Kraftpacker automatic open mouth bag filling machine, has developed two new Kraftpacker attachments. One attachment is designed to add and mix a desired amount of regular or pulverized insecticide or herbicide to each bag of fertilizer as it is filled by the Kraftpacker.

The other is designed to add liquid insecticide or herbicide to the fertilizer.

New Shipping Containers For Flowable Materials

A new family of returnable composite shipping containers for liquids and flowable materials was introduced at a press conference held recently at the Package Research Laboratory, Rockaway, Available in 5, 15, 30 and 55 gallon sizes. the new composite containers consist of an inner rigid poly-

ethylene drum, and an outer wire-bound wooden octagonal drum All four sizes have passed the MCA and ICC tests for regulated liquids, and may be used under permit for shipping "any liquid safe in polyethylene," including corrosive, tox-



ic and inflammable substances. The new composite packs are classified as drums.

The inner component is manufactured by Delaware Barrel & Drum Co., Wilmington, Del.



For IMPROVED PERFORMANCE

Add Trace Elements to your Brand Name Fertilizer . . . with Water Soluble

NUTRA-MIN

the only water soluble blend of: MANGANESE, IRON, COPPER, ZINC, BORON, MOLYBDENUM

Available in 100 lb, drums or factory blended with your material in our

CUSTOM PACKAGING DIVISION

in units of one pound or more. We package and ship under your own Brand Labels.

PRODUCTION LINE ECONOMIES
PLANT LABORATORY AND EXPERIENCED PERSONNEL FOR PRODUCING QUALITY CONTROLLED WATER SOLUBLE FERTILIZERS AT
METUCHEN, N. J.

Davies Nitrate Co.

IIS LIBERTY STREET NEW YORK 6, N.Y.

Trost Jet Mills

The Trost Jet Mill Co., Moorestown, N. J., is offering jet mills that are said to eliminate the dangers of contamination of the materials being ground because of abrasion of the walls of the grinding and collecting chambers.

According to the company, the Trost mills can be lined with alloy steels, silicon, tungsten, boron, carbide, or other materials that would be compatible with the material being ground. Engineered Materials, New York, has been appointed exclusive sales agent for the Trost jet mills.

Syntron Conveyor Catalog

The Syntron Co., Homer City, Pa., is offering a catalog section on mechanical conveyor screens designed for the scalping and coarse and medium sizing of a wide range of bulk materials.

The illustrated section contains complete descriptions, specifications, and data for three standard mechanical Conveyor Screen models.

Abbe Mixers Catalog

Paul O. Abbe, Inc., Little Falls, N. J., has prepared a catalog giving technical data and specifications of its complete line of mass and paste mixers and ribbon mixers. Included in the catalog are illustrations of equipment, various blade designs and arrangements, and other pertinent data. It is available from the company.

Deming Pump Bulletin

The Deming Co., Salem, Ohio, has prepared a bulletin to illustrate various types and sizes of Deming pumps engineered especially for moving liquid fertilizer.

Crown Bag Sealers

The Multiwall Bag Division of the Crown Zellerbach Corp., San Francisco, has announced the availability of two bag sealing innovations.

The Crown Thermo-Tape machine makes possible in-plant closure of sewn bags with polyethylene-coated tape and multiwall pasted valve bags may be durably sealed with the Crown Cuffed Tuck-in-Sleeve.

New Finco Drier



Finco, Inc., Aurora, Ill., has introduced a drier that is used to remove moisture from farm crops, fertilizers chemicals, charcoal, seed, feed, pellets, and numerous other products. The heat source can either be electrical or steam and temperature controls permit all types of heat ranges.

The drier features a variable air flow volume of from 4,000 to 30,000 cfm, and a variable speed control of the revolving cylinder.

Drum Filling Cover

The Delaware Barrel and Drum Co., Wilmington, Del., has developed a polyethylene drum filling cover, available in 15, 30, and 55 gallon sizes, to protect shipping drums from chemicals spilled during filling operations.

Stored Grains Booklet

A ten-page booklet entitled "Better Control of Insects in Stored Grains" is being offered by the Stauffer Chemical Co., New York. Among the subjects discussed in the booklet are sanitation methods, grain protectants, and fumigants.

2-in-1 Noble Applicator

Noble Manufacturing Co., Sac City, Ia., has introduced a new granular chemical applicator. which will apply a herbicide and insecticide at the same time. The unit is primarily a granule-holding hopper that is actually two hoppers in one. It mounts on all planters. listers, and seeders, and as the farmer plants, - one hopper compartment supplies the insecticide near the seed (ahead of the press wheel), while the other compartment feeds the prescribed 14-inch band of herbicide (behind the press wheel).

Dr. J. R. VAN DIEPEN has been named technical director of the newly-created Technical Department of the Niagara Brand Chemicals division of Food Machinery and Chemicals, Ltd., Burlington, Ontario, Canada.

AC

ROBERT KNIGHT has been named district manager in western Missouri, Kansas, and eastern Nebraska for the multiwall division of the Hudson Pulp & Paper Corp., New York.

AC

ARTHUR T. SCHRAMM, manager, field sales, National Aniline Division, Allied Chemical Corp., New York, was one of three persons from the United States invited to serve on the Expert Committee on Food Additives established jointly by the United Nation's Food and Agriculture Organization and the World Health Organization. The group met in Rome, Italy, Nov. 30 to Dec. 1.

WASHINGTON REPORT

(From Page 46)

use by salesmen in promoting the use and sale of fertilizers.

Estimates indicate that use of fertilizers would triple in many areas of the nation if all farmers could be sold on accepting college recommendations.

"The farm is a bull market for new products" and "The bottom is falling out of farm purchasing power" are two points of view that can be heard nearly everywhere farm leaders gather in Washington.

Overall farm buying power prospects for 1960 are not encouraging. Predictions are that farm income will be down about 25% from the 1958 level. Prices of many things farmers buy are up. With more farmers caught in the squeeze between falling income and higher costs, why the bull market for new products?

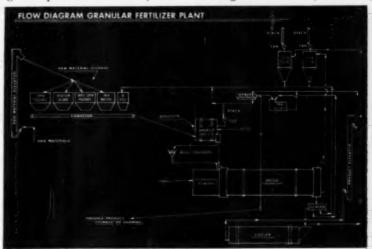
The reason, indicated by H. A. Miles, of the Farm Credit Ad-

ministration, Roswell Garst, the Iowa seed dealer, and others is this: agriculture is rapidly splitting up into different kinds of farmers. This has special significance for fertilizer and pesticide manufacturers, and for Congressmen who will be trying to pass some kind of new farm legislation during this year.

The farm groups are: 1) farmers who are trying everything new that shows promise of increasing their production efficiency and

reducing per unit costs. These farmers want to stay in farming, know they can do so only by becoming more efficient; 2) farmers who won't or can't modernize fast enough but want to stay in farming. They're taking off-farm jobs to round out their personal incomes; 3) marginal farmers who won't modernize or give up farming and those who are giving up in favor of city jobs.

In other words, agriculture can no longer be treated by marketing



flow diagram for COOLER-DRYER installation for granular fertilizer plant... planned, designed and built by



BROTHERS CO., INC.
ALLENTOWN, PENNSYLVANIA

WRITE FOR FREE BOOKLET

12 pages of diagrams, descriptions, and on-the-lob photographs to illustrate the scope of our work.

MANUFACTURING ENGINEERS OF COOLERS . DRYERS . KILNS

men or by legislators as a single bloc. This is why prospects for fertilizer sales and pesticide sales to farmers look about as good, in some cases better, for 1960 than for 1959 to many forecasters here.

Roswell Garst recently summed it up this way. Speaking of fertilizer, he said the first users started using plant food to make an extra profit, the next group of users were trying to keep up with their richer neighbors, and now

farmers have to use more fertilizer just to stay in the business. He looks for greater use of fertilizers, particularly in new markets, in 1960 and beyond. The same logic goes for pesticides.★

PRENTISS PLANT

(From Page 41)

fic components." He explained that the first stage is to strip off the petroleum fraction, the second

is to reduce the oil content, and the third is to extract the pyrethrins from the pitchy black residue, which is the only waste material thrown away during the process.

John Stoddard terms the process the most efficient and the most economical method of pyrethrum extraction in operation today.*

NATA ELECTS

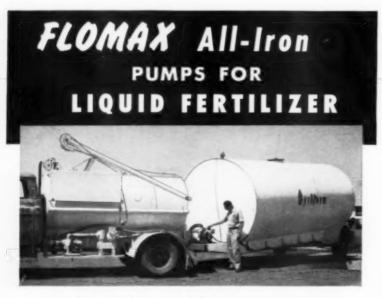
(From Page 60)

They are: Region 1-Alfred M. Bertolet, Reading Aviation Service, Reading, Pa.; Region II-Cy Emery. Magnolia Aviation Co., Laurel, Miss.; Region III-George Edgcumbe, Tufts-Edgcumbe, Inc., Elgin, III.; Region IV-Ralph Crosnoe, Red River Aero Dusting Co., Texarkana, Texas; Region V-Walter H. Ball, Dakota Aviation Co., Huron, S. D.; Region VI-Henry Moore, Moore Aviation, Tulare, Calif.; and Region VII-H. P. Hill. Idaho Aviation Center, Idaho Falls,

Resolutions passed by the NATA called for closer cooperation with the Civil Air Patrol; a survey of services provided by NATA members; the establishment by FAA of temporary airspace disaster areas for the protection of search and rescue operations; and the continuation of efforts to secure relief from discrimatory provisions of the Federal Wage Fair Labor Standards Act. Also, the NATA called for the establishment of an association public relations program, uniform standards for safe general aviation operating procedures, and an active association safety program.

The association stated its opposition to the establishment of a Federal Fire Fighting Corps as called for in H. R. 5665 and to the entry of the Federal Government into contracting for aerial application of agricultural chemicals to cultivated crops.

NATA's 21st annual convention will be held in Okalahoma City at the Oklahoma Biltmore Hotel, Dec. 6-8, 1960.



The truck is a mobile bulk station with its permanently mounted FLOMAX 8. The trailer, with its own FLOMAX 8, becomes a completely selfcontained nurse tank at any farm or ranch—no matter how remotely located. Agriform Co. (Wash.) uses FLOMAX pumps exclusively.

MP Pumps-the FLOMAX SELF-PRIMING CEN-TRIFUGALS-Engine Driven (or belt or electric motor drive) are now the standard for pumping Liquid Fertilizer.

The Open Adaptor: Liquid being pumped can never touch the engine shaft or bearing or get into the engine itself.

The greaseless Seal: covered by fluid at all times. Never

needs lubrication.

Continuous, uninterrupted operation is absolutely important. You must not have interruption of pumping during the handling or application of liquid fertilizer. You have continuous performance operation with the MP FLOMAX series.

All-Iron

for Liquid Fertilizer FLOMAX 5.... 5,800 GPH FLOMAX 8 8,400 GPH FLOMAX 10....11,100 GPH FLOMAX 15....15,900 GPH

Send NOW for complete information



MARINE PRODUCTS CO. 591 LYCASTE AVE. DETROIT 14, MICH.

PUMPS

MICROBIAL PESTICIDES

(From Page 33)

cles may be overcome through sound basic research.

The tendency of some diseases to cause portions of the insects to remain attached to the foliage of the host plant. This applies to some but not to others.

6. The requirement of some pathogens, notably most fungi, for high atmospheric moisture in order to invade and infest their insect host. On the other hand, most bacteria, viruses, and protozoa are ingested, wherein the body fluids of the host insect provide an ideal environment for development.

This applies to some but not to others. In some cases, this obiection can be overcome by proper formulation or application techniques. Let us recall that DDT in granular form decreased DDT residues on plants but actually increased the DDT concentration in the whorl of the plant where it did the most good. In this connection, I believe York and Brindley have found that Beauvaria bassiana, a fungus having a high moisture requirement, when applied as a spray did not give adequate corn borer control. However, when it was applied as granules which rolled down into the whorl of the plant where there was plenty of moisture, results were very encouraging.

The possibility of ever finding all of the enumerated advantages or disadvantages combined in any one organism seems fantastically remote, and it may be difficult to find very many pathogens possessing two or more outstanding advantages and devoid of any serious disadvantages. At the same time, the finding of several organisms suitable for practical use is not only possible but highly probable. Some may not have the broad spectrum of uses that one might hope for, but one or more substantial uses in critical areas may prove adequate to permit their commercial production and distribution.

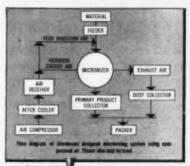
The results of recent research are encouraging, indeed, and an optimistic point of view seems fully justified. We must be ever mindful of the fact that ultimate victory is never attained until the last battle has been won. At this point we should also bear in mind that when a research worker reports the results of preliminary studies as "promising," that word "promising" may mean "maybe" or "it could be" to us, but it may mean "probably" if not "a near certainty" to someone else. Then, too, for some reason the average layman is prone to think of biological control, whether by parasites or disease, as something Utopian. This may stem from their observance of an epizootic that suddenly annihilated a tremendous population of aphids, chinch bugs, or grasshoppers. In any case, there is danger that if we should inadvertantly stimulate undue optimism in the minds of the public and oversell the program at this point, it could easily boomerang and seriously retard progress later on.

In summary I will give you one man's opinion—my own. Now I know this guy pretty well. He can be pretty close to right, and he may be dead wrong.

- I believe microbial insecticides will find a place for themselves in insect control in the not-too-distant future.
- (2) Just where, when, and how large a place, I cannot predict.
- (3) If I want to be sure of getting in on the ground floor: (a) I would watch developments very closely from month to month; (b) I might even get some experimental materials for some interested customers and work with them; (c) I would not wade in too deeply unless I had risk capital that I was prepared to lose if things turned out badly; (d) under no circumstances would I risk overselling a client or a customer.
- (4) To say it all in five words, I am optimistic but agnostic. In other words, I hope, but I don't know.★★

Need 1/2 to 44 Microns?

Sturtevant Micronizers*
Make 325 Mesh Obsolete



One Operation Reduces, Classifies

Sturtevant Micronizers grind and classify in one operation in a single chamber—provide fines in range from ½ to 44 microns to meet today's increased product fineness needs. Can handle heat-sensitive materials.

Production Model (15 in. chamber)

No Attritional Heat

Particles in high speed rotation, propelled by compressed air entering shallow chamber at angles to periphery, grind each other by violent impact. Design gives instant accessibility, easy cleaning. No moving parts.

Classifying is Simultaneous

Centrifugal force keeps oversize material in griteding zone, cyclone action in central section of chamber classifies and collects fines for bagging. Rete of feed and pressure control particle size.

Eight Models Available

Grinding chambers range from 2 in. diameter laboratory size (½ to 1 lb. per hr. capacity) to large 36 in. diameter production size (500 to 4000 lbs. per hr. capacity). For full description, request Bulletin No. 091.

Engineered for Special Needs

A 30 in, Sturtevant Micronizer is reducing titanium dioxide to under 1 micron at feed rate of 2250 lbs. per hr. For another firm, a 24 in. model grinds 50% DDT to 3.5 average microns at a solid feed rate of 1200-1400 lbs. per hr. A pharmaceutical house uses an 8 in. model to produce procaine-penicillin fines in the 5 to 20 micron range. Iron oxide pigment is being reduced by a 30 in. Micronizer to 2 to 3 average microns.

Sturtevant will help you plan a Fluid-Jet system for your ultra-fine grinding and classifying requirements. Write today.

Can Test or Contract Micronizing Help You?

Test micronizing of your own material, or production micronizing on contract basis, are part of Sturtevant service. See for yourself the improvement ultra-fine grinding can contribute to your product. Write for full details. STURTEVANT MILL CO., 123 Clayton St., Boston, Mass.



*REGISTERED TRADEMARK OF STURTEVANT MILL CO.

S L K L SILICA GEL

DEATH BY DEHYDRATION

... the dense silica insecticide that stays where it's laid

Cuts dissipation loss, goes further, more economical to use, easily applied with conventional equipment.

Silikil is long lasting, immunity proof, odorless, non-staining, effective even under high humidity conditions. Can be used in combination with other insecticides. Available in 1 lb. or 15 lb. cartons. Grades SILIKIL and SILIKIL D (extra dense). Write for further information and samples.

FEDERAL REGISTRATION

COCKROACHES AND TERMITES

SHOWS PROMISE ON

Fly control in barns Fleas on animals Fruit flies in packing plants Mites, Grasshoppers, Ants, Thrips and as a spray for Livestock Flies, Ticks, Lice and Scale Insects on fruit trees



Silikil on inside of above beaker covers glass completely and evenly for effective, economical application. Adhesive to glass, metal, wood or treated surfaces even under moist



Conventional silica insecticide (above) demonstrates uneven deposit that limits effectiveness, wastes material.



600 South Fourth Street Richmond, California

WRITE FOR NAME OF DISTRIBUTOR CLOSEST TO YOU



TYPE-41

KAOLIN CLAY

For Use in Extending Insecticidal Materials

- Non-Abrasive
- Small Particle Size
- Chemically Adaptable
- Good Adhesive Qualities

For information and samples, write:

SOUTHEASTERN CLAY COMPANY

AIKEN, SOUTH CAROLINA

AGRICULTURAL CHEMICALS

offers practical features on manufacturing processes, market information, merchandising aids, survey data, and technical and toxicological data on agricultural chemicals. Also included are monthly features by industry experts on topics of current interest, reviews of technical literature, new industry products, equipment, and bulletins and news about the agricultural chemicals industry.

CLIP AND MAIL TO

AGRICUL	TURAL	CHEMICA	ALS,	P.O.	Box	31,	Coldwell,	N.
Please er	ther su	bscription	(s)	as fo	llows	:		
(Check o	r mon	y order	encle	sed)				

☐ One year, \$3.00 (Canada \$4.00; Foreign \$9.00) ☐ Two years, \$5.00 (Canada \$7.00; Fereign \$15.00)

AME	witness.	 	
		(Please	Print)

N/

FIRM STREET

ZINC CAKING

(From Page 37)

also give very satisfactory results.

The physical condition of the additive is important in determining the eventual caking character of the product. In the tests described, individual zinc chelates as additives gave entirely different caking responses, depending upon the physical character of the chelate. In general, a coarse, freeflowing material yields a product of better condition than does a finely crystallized powder. A wellsuited chelate is capable of offsetting zinc-caking completely, but the solubility of the zinc in the mixture is lower than with other carriers. The decreased solubility is, however, not thought to reduce zinc availability to crops.

Slurry mixing, which allows the chemical reactions that cause caking to go to completion prior to storage of the material, gives a dense, fine-grained product that will cake, irrespective of the presence or absence of trace elements, as a result of the flowing together of crystals caused by the pressures produced in bag storage.

Acknowledgment

The authors wish to express their appreciation to W. L. Hill for his general counsel and direction of the work, to G. A. Wieczorek, Jr., for carrying out preliminary qualitative tests to help channel the direction of the investigation, to A. V. Breen for preparation of certain of the mixtures, and to the Geigy Chemical Corporation and the Dow Chemical Company for supplying zinc chelates.

Literature Cited

- (1) Adams, J. R. and Ross, W. H., Am. Fertilizer 95(2), 5-8, 22-24 (1941).
- (2) Adams, J. R. and Ross, W. H., Ind. Eng. Chem. 33, 121-7 (1941).
- (3) Assoc Offic Agr Chemists, "Offi-cial Methods of Analysis," 8th ed., 1955.

- (4) Boawn, L. C., Viets, F., Jr., and Crawford, C. L., Soil Science, 83, 219-27 (1957).
- (5) Merz, A. R., Fry, W. H., Har-desty, J. O., and Adams, J. R., Ind. Eng. Chem. 25, 136-8 (1933).
- (6) Nikitin, A. A. Advances in Agronomy 6, 183-97 (1954)
- (7) Raistrick, B. Fertilizer Soc. (Lon-
- don) Proc. 38, 46 pp. (1956). (8) Sandell, E. B., "Colorimetric Determination of Traces of Metals," 2nd ed., Interscience Publishers, Inc., New York, 1950.
- (9) Seatz, L. F. and Jurinak, J. J. in "The Yearbook of Agricul-ture: 1957. Soil," pp. 115-121., U.S. Department of Agriculture. U.S. Government Printing Office, Washington, D.C., 1957.
- (10) Silverberg, J., Lehr, J. R., and Hoffmeister, G., Jr., J. Agr. Food Chem. 6, 442-8 (1958).
- (11) Whynes, A. L. and Dee, T. P., J. Sci. Food Agric. 1957, No. 10, 577-91.

APPLICATION METHODS

(From Page 63)

ly over the soil surface and cutting them in with a disc harrow; and the placement of the DBCP granules six to eight inches deep on 12-inch centers by means of a modified small grain drill (or fertilizer spreader) with fertilizer spouts and points added (figure 4).

The solid treatments were sealwith a drag to prevent rapid and excessive loss of the chemical.

The DD mixture was applied as in-the-row preplanting treatment, at the rate of 12.6 gallons per acre. The DCBP plots were treated 25 days later, on the same day that the DD-treated beds were opened to apply fertilizer.

On April 30, 1958, five days following the DCBP treatments, squash seed and root-knot-free tomato transplants were planted. Hills for both test plants were spaced two feet apart. For an earlyseason root-knot index, alternate tomato plants were dug on June 10. Both tomato and squash plants were dug and indexed for severity of root knot attack after the last harvest. Individual plants were scored for infection on a scale ranging from O (no galling), to 4 (severe galling). The results are presented in the table (page 63).



Glendon Plant and Mines at Glendon, N. C.

the ideal diluent and extender for agricultural insecticides

INSECTICIDE GRADE

- pH 6 to 7
- 92 to 95% will pass a 325 mesh screen
- Wt.—32#/cu. ft.
- Aver. particle size below 5 microns
- Chemically inert
- Non-alkaline

Dusts compounded with Glendon's Insecticide Grade Pyrophyllite will not absorb moisture, nor will the carrier separate from the active ingredi-ents during storage. It holds well on plant leaves, even during rain, and when dusted from the air, settles rapidly, minimizing drift.

GLENDON DIVISION

CAROLINA PYROPHYLLITE COMPANY

P. O. Box 2414

GREENSBORO, N. C.

According to the root-knot indices for both kinds of test plants, all methods of application and both chemicals reduced infection enough for statistical significance. Except in the plot in which granular DBCP was mixed into the soil with a disk harrow, solid applications of DBCP gave better rootknot control than comparable row applications of DBCP or DD mixture. DBCP was superior to DD mixture in the row treatments. In the row treatments with DBCP. the liquid formulation gave better control than did the granular material, but in the solid treatments, both were equally effective.

The results of this experiment tend to confirm other reports that DBCP does not always give satisfactory nematode control when it is spread on the soil surface and worked in with a disk harrow, unless it is used at higher dosage rates than normal. The rate for solid application of DBCP in this experiment was one-half higher than usual, but control from the

disk-harrow method was not equal to that from other solid application methods or from the row applications. Loss of fumes from the chemcial mixed into the upper two to three inches of soil is the probable explanation. The difficulty of obtaining a killing concentration of fumes in this part of the soil is well known and this method probably would be even less effective on heavier soils since it would be harder to mix the chemical into them,

If, however, granular formulations of DBCP are placed at sufficient depths in the soil, they are as effective as liquid preparations applied by chisel injection. In addition, granular formulations are easy to handle and to calibrate. In this experiment, however, loss of efficacy resulted when granular DBCP was mixed with fertilizer or applied separately on the fertilizer furrow. Nematocides give best results at depths of six to ten inches, whereas fertilizers seldom are placed so deep in the soil. ***

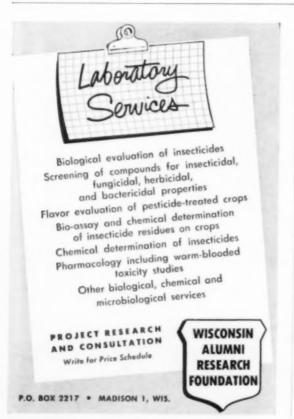
PEST ROUNDUP

(From Page 65)

mill a medium infestation was found in bins and salt sacks. Medium infestations were also found on salt sacks in a mill in San Diego and in a storage building in Borrego, San Diego County. It is believed that these establishments became infested through a salt shipment.

Khapra beetle was found in two properties in Maricopa County, Arizona, during September and one in October. As of early November, only six known infested properties remained to be fumigated in Arizona. Two infestations in El Paso, Texas, were fumigated in September. This completed treatment of all known infestations in that state. Continuing surveys in other states and the Republic of Mexico have been negative.

The cooperative survey to determine the number of boll weevils entering hibernation this



DDVP

DIMETHYL DICHLORO VINYL PHOS-PHATE is now being used in sugar-based fly baits and as a phoracide in mushroom culture and for control of cigarette beetle in tobacco warehouses. Because of its high insect toxicity in very low concentrations, and its relatively low toxicity to warm-blooded animals and lack of residue, experimental work is suggested in many fields of application.

DDT

Available in powder, flake and Krisp Chips.

Manufactured by

MONTROSE CHEMICAL COMPANY

104-112 Lister Avenue - Newark 5, New Jersey

For samples and technical data on DDVP and DDT, write to:

R. W. GREEFF & CO., INC.

10 Rockefeller Plaza, New York, N. Y. Tribune Tower, Chicago, Illinois fall has been completed in several areas. In Mississippi the trash samples to be examined were collected from the Lower Delta, Central Delta, North Delta and Hill section of the state. The average number of live weevils found per acre of trash averaged 5,127 for all areas. The average for the same areas was 3,791 in 1958, and 6,715 in 1957.

Trash samples were collected in the Louisiana Parishes of Madison, East Carroll, and Texas. The average number of live weevils per acre of trash for the tri-parish area was 8,097. In 1958 the comparable number was 5,756 and 8,043 in 1957 for the same area.

The Tennessee boll weevil hibernation survey was conducted in McNairy County. Live boll weevils found averaged 1,882 weevils per acre of trash. The average for the same area was 1,214 live weevils per acre of trash in 1958 and 2,365 in 1957.

The coastal plains area of North and South Carolina averaged 5,082 live boll weevils per acre of trash. The average for the same area in 1958 was 4,625 per acre and 11,374 in 1957.

The fall boll weevil hibernation survey was conducted in Texas for the first time this year. Trash collections were made in McLennan, Falls, Hill and Limestone Counties.

Average number of live weevils per acre of trash for the area was 6,631. Comparative figures are not available for previous years. However, observations indicate that weevils in greater than normal numbers were available to enter hibernation quarters this fall.

Although weather and other factors are responsible for the populations that will develop next spring, the number of boll weevils entering hibernation in the fall does indicate the potential population for the next year. A spring survey will be conducted in the same general areas to determine the number of overwintering weevils.

PROFESSIONAL DIRECTORY

SOIL & PLANT TESTS
SOIL FERTILITY PROBLEMS

EVALUATION OF AGRICULTURAL CHEMICALS

Dr. Wolf's Agricultural Laboratories 2620 Taylor St. Hollywood, Fla.

Chemical & Engineering Analyses, Research & Development

Agricultural Chemical Analyses.
Insecticides, Fungicides, Herbicides,
Rodenticides, Fertilizers.
Toxicology. Market Research.
Product Development.
Ask for complete details; call—
Watkins 4-8800

Foster D. Snell, Inc.
29 W. 18th STREET
New York 11, N. Y.

'LAB TO LABEL'

Service, Facilities, Experience
in SCREENING and DEVELOPMENT of
AGRICULTURAL PESTICIDES
NEMATOCIDES-INSECTICIDES
FUNGICIDES
BACTERICIDES-HERBICIDES

Ask for Brochure
BIO-SEARCH & DEVELOPMENT
COMPANY

2019 W 71 Terr. Kansas City 15, Mo. Dr. J. B. Skaptason, Pres.

A. EDISON BADERTSCHER

Graduate Entomologist

Consulting — Labels — Products Thirty years experience in prepation of labels and compounding household, industrial, and garden insecticides, pet products, insect repellents, and soluble plant foods.

Science Center Building
1113 N. Rolling Rd. Baltimore 28, Md.
Phone: Ridgeway 7-1044

AC ON MICROFILM

All issues of AGRICULTURAL CHEMICALS are available on Microfilm,

Librarians and other interested subscribers can contact University Microfilms, 13 North First Street, Ann Arbor, Mich., for price information and copies.

-- COMPLETE ---

Small and Large Animal Research Toxicity Tests, Human Patch Tests. Bacteriology—Screening, Testing. Research—Bactericides, Fungicides Chemistry—Visible, Ultraviolet, Infrared Spectroscopy, Chromatography. New Products. Pilot Plant.

Write for Brochure.

SCIENTIFIC ASSOCIATES
3755 FOREST PARK AVE.
ST. LOUIS 8, MO. JE. 1-5922

FLORIDA FIELD TRIALS

Evaluations
of
Agricultural Chemicals.

DR. G. R. TOWNSEND

Box 356

Belle Glade, Florida

Theodore Riedeburg Associates Consultants

Marketing & Development Agricultural Chemicals Chemical Specialties

415 Lexington Avenue New York 17, New York MUrray Hill 7-1488

ALVIN J. COX, Ph.D.

Chemical Engineer and Chemist

(Formerly Director of Science, Government of the Philippine Islands. Retired Chief, Bureau of Chemistry, State of California, Department of Agriculture.)

ADVISER ON AGRICULTURAL CHEMICAL PROBLEMS AND INVESTIGATIONS

Consultant in reference to apray injury and damage, claims, including imports of fruits and nuts, formulas, labeling, advertising and compliance with law.

1118 Emerson Street Palo Alto, California

LABORATORY SERVICES

Research—Development—Consultation— Analyses
Toxicology—Pharmacology

Toxicology—Pharmacology Pesticide Residue Studies Research Farm Facilities Write for Brochure

HARRIS LABORATORIES, INC.

Chemists—Pharmacologists—Batteriologists 816 "P" Street HE 2-3689 Lincoln 8, Nebraska Member American Council Independent Laboratories



ANOTHER FAMOUS



THE NEW KLM DC-8 JET CARGO SERVICE. The original "40&8" was a French boxcar during World War I. The boys in the A.E.F. knew it as their Pullman to the front. After that ride, it was all on foot, through the mud to the trenches. The "40&8" took its name from the load capacity stencilled on its side . . . 40 Hommes & 8 Chevaux . . . 40 Men & 8 Horses. It was and is the most famous boxcar in history. But now, KLM whose own history dates from World War I, introduces another "40&8," destined to be just as famous in its own right. On its 40th Anniversary, KLM introduces its new DC-8 Jet Cargo Service, soon ready to carry your products to the selling fronts the world over. It will deliver your shipments in a few hours or overnight to any market on the globe. It will reduce your inventory and handling costs, open up vast marketing areas to increase your profits. For more information on the new KLM "40&8," contact your freight forwarder, cargo agent or KLM, 609 Fifth Avenue, New York 17, N. Y.— PLaza 9-2400.



CLASSIFIED ADVERTISING

Actions all classified replies to Box Number, c/o Agricultural Chemicals, P. O. Box 31, Caldwell, N. J. Thelp Wanted" advertisements are 20¢ per word; minimum charge \$3.00. Rate for individuals seeking employment is 5¢ per word, \$1.00 minimum.

Advertisements of new machinery, products and services accepted at rate of \$10.00 per column inch. Minimum spaces, inch. Minimum spaces, inch. Copy closing date, 10th of preceding month.

Checks must accompany all orders.

Situations Wanted:

4

AGRICULTURAL ENGINEER B.S. degree, Desire position with fertilizer concern. Experience in fertilization procedures and forms of application and plant nutrition, Knowledge in soils. Age 27, single. Will relocate. Salary open. Address Box 260, c/o Agricultural Chemicals.

FOR SALE: UNUSED #9 Sturtevant rotary blender, 150 cu. ft. T304 st. st. dry material handling system, including: 1800 cu. ft. weight hoppers; AJAX "Lo-vevor" shaker conveyors; bucket elevators; screw conveyors; all T304 st. st. Send for details.

PERRY EQUIPMENT CORP.

1428 N. 6th St. Phila. 22, Pa.

FIRST CLASS EQUIPMENT FROM YOUR FIRST SOURCE

Double Ribbon Blenders; all sizes Tumbling Batch Mixers to 300 cu. ft. Hammer Mills, Pulverizers, Crushers, Sifters, Separators and Screens, Stainless Tanks, Kettles, Reactors, Raymond Imp Mills, Whizzers etc. Dryers, Coolers, Evaporators.

We Buy Your Surplus Equipment Send for "FIRST FACTS"

FIRST MACHINERY CORP.

209-289 Tenth St., Brooklyn 15, N. Y. STerling 8-4672

\$3,000,000 LIQUIDATION CHEMICAL PLANT AT ORANGE, TEXAS

Type 316 Stainless Steel Tanks, Kettles, Heat Exchangers, Columns, Stills, Crystallizers, Centrifugals, Pumps, Valves, etc. WONDERFUL VALUES. SEND FOR LIST

PERRY EQUIPMENT CORP.

1428 N. 6th Street, Philadelphia 22, Pa.

INTERESTED IN POSITION representing a progressive concern relative to Agricultural Chemicals in Oregon. Have a degree in Entomology and have had experience in fertilizers and pest control phases in crop production for 25 years. Also have considerable knowledge of chemicals themselves, their uses, toxicities, residues and general pest control in most of Western United States. Could use home as headquarters (28 miles from Portland). Reply Box 262, c/o Agricultural Chemicals.

DUTCH AGRONOMIST, M.S., seven years research experience on a very large sugar estate desires position in research or industry in/or outside the U. S. A. Speaks English, German, Spanish and Dutch. Age 32, married, one child. Will be available for interview. Address Box 264, c/o Agricultural Chemicals.

ZONOLITE VERMICULITE

tive, inorganic, lightweight carrier for any type chemical. Low density. Cuts carrier costs. Formulates without caking or balling up. Technical information and assistance to help you work out new formulae on confidential basis. Also working aampies, prices. Dependable service and supply from over 40 ideally located Zonolite plants.

ZONOLITE COMPANY, Industrial Div. Dept. AC-10, 135 S. LaSalle St., Chicago 3, Ill.

SALES MANAGEMENT OR BASIC SUPPLIER REPRESENTATIVE for fertilizer or agricultural chemicals. Agricultural graduate, 15 years successful experience—management and sales. Desires change. Address Box 261, c/o Agricultural Chemicals.

Help Wanted:

BASIC MANUFACTURER of amazing low cost water soluble conditioner has selling opportunity for agents calling on fertilizer producers. Attractive commission, good steady repeat volume. Please advise territory now covered and lines handled at present Reply Roy 263 c/o Agricultural ent. Reply Box 263, c/o Agricultural

ROBERT C. HARNDEN has been named to the newly-created post of executive vice-president of the Chapman Chemical Co., Memphis, Tenn. He had been vice president in charge of the company's agricultural chemicals division since 1950

> 1 Yr. \$3.00 2 Yrs. \$5.00

ARE YOU KEEPING IN TOUCH WITH YOUR INDUSTRY?

Complete up-to-date news of the agricultural chemicals industry is reported monthly in

AGRICULTURAL CHEMICALS.

Enter your subscription now and keep informed!

AGRICULTURAL CHEMICALS P. O. Box 31, Caldwell, N. J.

YES! Send me Agricultural Chemicals Enclosed is my check for \$

Name Address City Company

Claims and Counter Claims

E shouldn't be at all surprised if the claims and counterclaims made by numerous trade papers with which the agricultural chemical field is so well supplied might easily confuse rather than enlighten the advertisers they are trying so hard to impress. One acclaims itself to be the merchandising and marketing publication of the industry, while another professes alternately to be the "complete sales medium" or the "complete advertising medium" for the industry.

There are regional publications and technical journals serving the field, and a host of special issues which have various tags on them to indicate some specific sphere of interest with which they are supposed to be exclusively concerned. All profess to serve the broad expanding market for plant foods and pesticides which AGRICULTURAL CHEMICALS first recognized thirteen years ago as a field not served by any specialized trade paper then existing.

It was our idea at the time-and one which

we still hold, incidentally,—that the best way to edit a first rate trade paper for this or any other industry is to stick to a sensibly balanced content—something on production, something on sales, practical technical articles to interest the production man, management and sales articles for the top executives, and news content of course for all. The balance we were looking for was something to interest each potential reader among the industry's top management and production executives,—without getting top heavy in any one direction.

We still have the feeling that the industry must agree with us, for AGRICULTURAL CHEMICALS is still the only trade publication in the field that has 5,000 subscribers from the top executives of leading fertilizer and insecticides companies. Each of these key men, by the way, pays for his copies to make sure that he sees every issue of the industry's leading publication.

AGRICULTURAL CHEMICALS

P. O. Box 31

Caldwell, N. J.

INDEX to ADVERTISERS

Allied Chemical Corporation—	
Nitrogen Division	0 66D
American Agricultural Chemical Co	Dec.
American Cyanamid Co.	24
American Potash & Chemical Corp	Dec.
Amoco Chemicals Corp	Dec.
A. Edison Badertscher	97
Bagpak Div., International Paper Co.	
Baughman Manufacturing Company	Sept.
Bemis Bro. Bag Co	
Bio-Search & Development Co	
Bradley Pulverizer Co	23
Chase Bag Co	Dec
Clark Equipment Co.	
R. D. Cole Mfg. Co.	
	Dec.
Combustion Engineering, Inc., Raymond Division	13
Continental Can Co.	
Commercial Solvents Corp.	
Cox, Dr. Alvin	
Cox, Dr. Alvin	
Davies Nitrate Co	90
Davison Chemical Division,	
W. R. Grace & Co	22
Diamond Alkali Co.	Oct.
Dorr-Oliver Inc.	Dec.
Dorsey Trailers	Oct.
Duval Sulphur & Potash Co	Sept.
& Chemical Corp	1.6
Eastman Chemical Products, Inc.	
Escambia Chemical Corp.	
Escambia Chemical Corp.	Oct.
Fairfield Chemical Div., Food	
Machinery & Chemical Co4th	Cover
Flexi-Liner Co	87
Flexo Products, Inc.	Dec.
Floridin Co.	14
Fry Co., Geo. H	84
Coins Assisultural Chamicals	

Glendon Pyrophyllite Co95
Grace Chemical Co., Division of W. R. Grace & CoNov.
W. R. Grace & Co
Grumman Aircraft Engineering Corp.58, 59
Hahn, Inc64
Harris Laboratories Inc97
Hercules Powder Co12
Hi-Shear Rivet Tool Co54
Hooker Chemical Corp4
William Houde, LtdNov.
Huber, J. M. CorpOct.
International Paper Co.,
Bagpak Division
International Minerals & Chemical
Corp50, 51
Johns-Manville Co75
Kennedy Van Saun Mfg. & Eng. Corp80
KLM Royal Dutch Airlines98
Kolker Chemical CorpOct.
Kraft Bag Co17
Magnet Cove Barium Co
Marine Products Co92
McDermott Brothers Co91
Merck & CoNov.
Monsanto Chemical CoDec.
Niagara Chemical Division, Food Machinery & Chemical CorpSept.
Nitrogen Division—Allied Chemical
Corp66A to 66D
Nopco Chemical CoOct.
Olin Mathieson Chemical Corp78, 79
Penick & Co., S. BOct.
Phelps Dodge Refining Corp7
Phillips Chemical Co Dec.
Piper Aircraft Corp61

Potash Company of America	
Poulsen Co.	
Prentiss Drug & Chemical Co	ec
Randolph Products Co.	Á
Raymond Bag Co	
Raymond Division, Combustion	01
Engineering, Inc.	1
Reideburg, Theodore Associates	
Renneburg & Sons Co., Edw	
Republic Steel Corp	
Richardson Scale Co	
Rohm & Hoos Co	11
Max Rouse & Sons	ec
A. J. Sackett & Sons	ec
Scientific Associates, Inc.	97
Snell, Foster D., Inc	
Sohio Chemical CoNo	
Southeastern Clay Co	
Southwestern Engineering Co	
Southwest Potash Corp.	
Spencer Chemical Co	
Sperling Laboratories	
Spraying Systems, Inc.	
Standard Oil Co. (Indiana)	
Stauffer Chemical Co	
Stepan Chemical Co2nd Co.	
Sturtevant Mill Corp	9;
Swift & Co	1.
Tennessee Corp	9.6
Texaco, Inc.	
Texas Gulf Sulphur Co	
Thomas Alabama Kaolin Co	
Townsend, Dr. G. R	97
ransland Aircraft	54
Union Bag-Camp Paper Co3rd Co.	ve
Union Carbide Chemicals CoNo	
Jnited-Heckathorn	
J. S. Industrial Chemical Co	
J. S. Phosphoric Products, Div., Tennessee Corp8,	9
United States Borax & Chemical Corp.	
/anderbilt Co., R. T.	
Velsicol Chemical CorpNo	
/ulcan Containers	PC
Weighing and Control Components,	
IncSer	
West Virginia Pulp & Paper Co	
Will Corp	
Wilson & Geo. Meyer & CoNo	
Visconsin Alumni Research Foundation	
Nitco Chemical CoDe	
or. Wolf's Agricultural Labs.	

TALE ENDS

Our agents warn us to look for more "bird kill" trouble from the midwest. The wildlife agencies have been getting an increasing number of complaints of kill of song birds, including a high number of robins, as a result of spraying to control Dutch Elm disease. The source of the trouble is the usual one—too heavy an application by inexperienced or careless personnel. If the quantity of DDT applied is kept down to a half pound per tree, adequate to give control of the disease, there should be no cause for complaints of harm to wildlife.

And, while on the wildlife question, we heard a comment recently regarding the threat to the American Bald Eagle which some bird lovers have claimed is fucing extinction because of pesticide poisoning. A much more serious threat to the country's national bird this observer remarked, is that the bird watchers spend so much time spying on the eagle's home life that Mrs. Eagle never gets much chance to keep the eggs warm.

AC

David E. Price, Chief, Bureau of State Services, Public Health Services,

Washington, D. C., made some very interesting observations on the "Bird vs. Insecticide vs. Man" problem at the recent 55th annual meeting of the National Audubon Society. While expressing concern over the possible longterm effect on birds and man of absorption of small, diluted quantities of pesticides, he also raised the question as to whether or not it may eventually become necessary to reduce bird populations. He observed that bird populations are much more concentrated in urban than in rural areas (827 per 100 acres in suburban residential areas - 465 in deciduous forests - 144 per 100 acres in grasslands). As bird density increases, he asks, "will the threat of encephalitis outbreaks become more serious?" If relationships become apparent between density of bird populations and human disease, he expressed the fear that control of bird populations through rather extreme measures might become necessary. Quite a turn about, we thought, for the Audubon Society members to hear that eventually we might have to start killing off some of our excess birds to protect human health.

AC

"Wallaces Farmer" and Radio Station WHO, in cooperation with Iowa State University and many civic and educational groups will collaborate on a Farm Progress Show to be held in Iowa following next season's corn harvest. Such programs as this are becoming increasingly popular in the farm community, particularly in the midwest. Crowds as large as a hundred and fifty or two hundred thousand are not unusual,—and what an opportunity these shows provide to promote the sale and effective use of fertilizers and pesticides.

AC

N.P.F.I. previewed its new movie, "Bread from Stone" early in December at a private showing in Washington. Prints of the all color film, with a running time of about 15½ minutes, will be available after Feb. 1, 1960. According to Dr. Russell Coleman, executive vice president, NPFI, the film, which is designed for the non-farm audience, is an effort to present the farmer's story objectively so that the American public can make a fair appraisal of the present agricultural situation.

AC

A "definite improvement in the milk residue picture" is reported by the U.S. Food and Drug Administration in its latest report on the subject, just released. The F.D.A. tested 936 samples of milk in 17 cities and found substantial amounts of pesticides in only about 3% of the total. In another 8% of the samples it was suspected that traces of pesticides might be present. but the residues, if any, were so small that it was impossible to establish definite contamination. By contrast, in a similar survey conducted in 1955. about 62% of milk samples were found to contain illegal residues.

A TYPICAL AGRICULTURAL CHEMICALS SUBSCRIBER SAYS

"I Read Agricultural Chemicals Regularly to . . .



Keep abreast of the technical developments, new processes, machinery improvements, and market forecasts. Only in Agricultural Chemicals are the many facets of our segment of chemical processing set out in a concise, factual manner that is readily retainable in the technical mind.

H. L. Marshall
Olin Mathiesen Chemical Corp.
Baltimore, Md.

"Doc" Marshall has been active in the fertilizer industry for more than 30 years. He participated in the formation of the Fertilizer Industry Round Table, and has been on its Executive Committee as secretary-treasurer since its formal incorporation. He is a graduate chemist from the University of Maryland. Before joining Olin Mathieson in 1946, he was with the U. S. Dept. of Agriculture and TVA.

The Curtis Bay (Maryland) plant of Olin Mathieson, where Dr. Marshall is chief chemist, manufactures mixed fertilizers, granulated fertilizers, sulfuric acid, superphosphate, and aluminum sulfate.

- Leader in the Field -

AGRICULTURAL CHEMICALS

CALDWELL

NEW JERSEY

Member Audit Bureau of Circulation

in the last two years over 210 multiwall users cut their packaging costs through a UNION-CAMP

another FREE service of the Star Packaging Efficiency Plan!

UNION-CAMP's 5-Star Plan has helped over 210 firms reduce their materials handling costs within the last two years alone. The economies resulted directly from a single service feature of the plan...a plant survey.

One survey, made for a midwest packer, speeded his multiwall handling operation by 50 per cent. Another company, by following UNION-CAMP recommendations, released labor for more productive functions and saved \$37,584. A third multiwall user lowered his costs by nearly \$50,000 a year. And there are many more such success stories.

A UNION-CAMP multiwall specialist will be glad to

review your present operation . . . show you how the 5-Star Plan can help produce more economical, more efficient control. The plan also covers bag design, bag construction, specifications control and packaging machinery. It's yours without cost or obligation.

Why not start cashing in on it today?



MULTIWALL BAGS

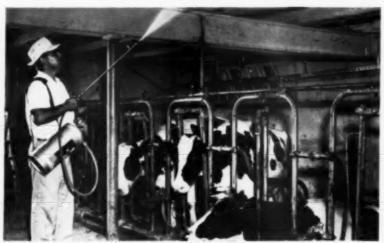
Union Bag-Camp Paper Corporation 233 Broadway N V 7 N V



Fairfield Facts

DAIRY EDITION

FLY CONTROL MEANS BETTER MILK



ARE THESE COWS PROTECTED! Increased insect resistance in 1960 will make many oncesuccessful insecticide formulations obsolete, emphasize researchers at Fairfield Chemicals, Food Machinery and Chemical Corp. Use of maximum-effectiveness insecticides containing Pyrenone assure animals of complete protection and prevent loss of farm income due to drop in milk quality.

Flies Find Dining Is Dangerous When Pyrenone Is On The Menu

Flies are finding it more dangerous lately to attack grazing animals. Not only is it proving uncomfortable for the flies, but it's becoming downright fatal.

Farm use of insecticide and repellent combinations like Pyrenone* and Crag Fly Repellent† afford additional, dual protection to grazing animals...protection that kills flies on contact and repels future attacks for several days.

Field tests show that sprays only utilizing repellents have limited value. Flies, gnats and mosquitoes stay in the area, bothering animals and attacking nontreated stock. When grazing cattle are annoved by insects, quantity and quality of milk yields suffer.

Versatile Pyrenone and Crag Fly Repellent combinations are available as oil sprays and emulsions. Highly effective, they are accepted under the Miller Bill on a "non-residue" basis. No trace

U.S. Pat. Off. PMC 1U.S. Pat. Off. U.C.C.

of approved formulations appears in milk or meat of treated animals. Send for free technical bulletin No. F-1.

Copies of the following booklets may be obtained from local Fairfield representatives or by writing to Fairfield Chemicals, Food Machinery and Chemical Corporation, 441 Lexington Avenue, New York 17, New York.

DAIRY, LIVESTOCK AND CATTLE SPRAYS AND DUSTS — Free booklet describing Pyrenone formulations for aprays, emulsifiable concentrates, wettable powders, fogging sprays, Pyrenone and repellents, Pyrenone aerosols, cow bombs.

TECHNICAL BULLETIN No. F-1 — Free bulletin describing Pyrenone and Crag Fly Repellent formulations.

FAIRFIELD FACTS FINDER—a new, 20-page comprehensive guide and unique, revolving calculator covering Pyrenone base formulations for dairy, garden, home and industrial sprays, aerosols and powders as well as an index of insects and peats. Price—\$1.00.

Putting Ideas to Work



FOOD MACHINERY AND CHEMICAL CORPORATION

Fairfield Chemicals

Sales Headquarters

441 LEXINGTON AVENUE, NEW YORK 17, N. Y.

Branches in principal cities. In Canada: Natural Products Corporation, Montreal and Toronto.

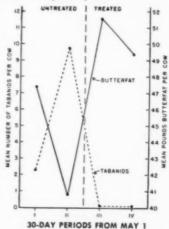
Pyrenone Formulations Keep Cows Contented As Flies Get Tougher

Formulators whose insecticides offer Pyrenone's maximum protection will get a greater share of farm business during 1960. Field tests prove that maximum control of biting flies means better milk—hence, more money for the farmer.

With flies becoming harder to kill every year, dairymen can't risk insecticides that lose their "punch." Entomologists reveal that in some areas last year, they changed formulations two and three times to maintain fly control. Non-toxic Pyrenone appeared in virtually every final successful insecticide.

Milk quality suffers when biting fly control is below maximum. In Illinois, during a May-June span, twelve herds not protected by an effective insecticide lost 13 to 14.8 percent in butterfat. A 1-percent piperonyl butoxide and 0.1 percent pyrethrins Pyrenone emulsion used twice a week in amounts of 10 to 15 ounces per cow brought butterfat back to normal in a month.

Effective Pyrenone formulations for sprays, emulsions, powders, etc., are included in a free booklet, "Dairy, Livestock and Cattle Sprays, and Dusts," available upon request.



Mean number of tabanids and mean pounds butterfat produced per animal during four successive 30-day periods for seven animals in similar stages of lactation. Treatments started the last day of the second 30-day period.

